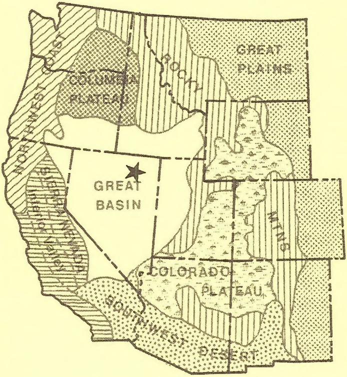
Saval Ranch Research and Evaluation Project



PROGRESS REPORT 1983

May 1984

PROGRESS REPORT FOR 1983

SAVAL RANCH RESEARCH AND EVALUATION PROJECT

Editors

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Unpublished and Preliminary Information

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SAVAL RESEARCH AND EVALUATION PROJECT

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HIGHLIGHTS OF YEAR

PUBLICATIONS	Five publications are now listed as project contributions (p.4).
PROFESSIONAL AND PUBLIC SERVICE ACTIVITIES	Project personnel gave 21 educational and scientific presentations in 1983 (p.5).
ORGANIZATION	Major reorganization of project was completed (p.131 - Appendix I).
COORDINATED MANAGEMENT PLAN	All parties agreed to make formal the change to a deferred rotation system on National Forest pastures. Four new cattleguards were installed to facilitate research work. A total of 6252 AUM's was grazed in 1983.
CLIMATOLOGY	Data collection at all eleven stations continued as planned, except for loss of data for two months at station 2, due to equipment theft. 1983 precipitation total is estimated to be 50% to 100% above longterm average for area.
HYDROLOGY	Summary of all climatological and hydrologic data sets is provided (Table 2.1, p.21). Recommendations for future directions also appear (p.22). Turnover of personnel in 1983 has slowed data analysis work.
VEGETATION	Peak crested wheatgrass production in 1983 was 702 lb/ac, slightly more than in 1982, and more than double that in 1981. Total production of herbaceous species on three major range sites was also greater in 1983 than in 1982. Utilization was generally less than in past years due to the smaller cow herd and possibly due to increased forage production. Wet and dry meadows and aspen woodlands were heavily grazed. Sandberg, Kentucky, and Nevada bluegrasses; spike fescue; sedges; rushes; Great Basin wildrye; and bitterbrush were preferred species.

Seed yield of crested wheatgrass and increaser species, Sandberg bluegrass and squirreltail, was much greater than for decreaser species, Thurber needlegrass. Seedlings of increaser grasses and of big and early sagebrush were found on both desirable and undesirable soil surfaces. Most seedlings of decreaser grasses were found on desirable soil surfaces.

<u>SAGE GROUSE</u>

Study population showed slight increase in 1983 after three years of decline (Table 4.2, p.44). Only 17 birds were bagged by hunters. Two of these were banded males; one of which was shot 16 miles from banding site. Early snow accumulation led to major shift in use to Wyoming big sagebrush types through most of the winter. In 1982, when snow accumulation was later, wintering birds showed a tendency to remain on the preferred alkali sagebrush.

<u>MULE DEER STUDIES</u>

Graduate student D. Selby has completed initial diet studies. She is presently writing her thesis. An affiliated study of use of aspen communities is being initiated.

<u>NON GAME WILDLIFE</u>

Mourning doves continued to be observed in the Mahala Creek drainage but were not seen elsewhere in 1983. Mahala Creek plots also showed the highest relative abundance of birds and highest diversity (Table 6.1, p.64).

<u>FISHERIES</u>

The cutthroat trout population continues to fluctuate with changes in abundance of as much as 50%. After two years of protection Very slight improvements in some streambank (riparian zone) features are detectable.

<u>LIVESTOCK</u>

Diets of fistulated cattle on four different pastures ranged from 92% to 98% grass species. Heavy use of meadow range sites on National Forest pastures led to a shift to use of forb, shurb and upland grass species by fistulated cattle put in after the main herd.

<u>LOWER SHEEP CREEK SEEDING</u>

A chapter combining early results on the seeding from all disciplines has been prepared (p.90). The 2400 acre treatment has increased available AUM's from 310 AUM's to 955 for the 4600 acre pasture. Sage grouse made significant winter use of the

pasture, including residual sagebrush in plowed areas (p.96). Least chipmunks are significantly less abundant. Several pronghorn antelope have also been observed on the area. Economic benefits to the ranch have not been as great as original estimates predicted. Maximum benefits to ranch will be achieved if additional winter feed or forage is obtained.

RANCH ECONOMICS

Labor cost summaries and analyses for the ranch have been completed (p.126). Three publications are in press or undergoing editorial review.

DATA MANAGEMENT AND MODELLING

Progress has been made toward achieving a common data base using BLM's Denver Service Center capabilities. An additional workshop on modelling and research integration has been held, focusing on the riparian zone.

TABLE OF CONTENTS

INTRODUCTION

The Saval Ranch Research and Evaluation Project was initiated in May, 1978. The overall objective is to evaluate the effects of livestock grazing management systems and range improvement practices on livestock production, vegetation, fish and wildlife and their habitat, watershed hydrology, water quality, economic factors, and other resource values.

The Project is conducted on the Saval Ranch, a privately owned enterprise located in northeastern Nevada. The ranch, livestock and grazing allotment are made available for this interdisciplinary study by the Saval Ranching Co. The allotment contains 49,105 acres; 7,557 acres are privately owned, 25,900 acres are managed by the Bureau of Land Management, and 15,600 acres are managed by the Forest Service.

Funding and support are provided by the Bureau of Land Management, U.S. Forest Service, Agricultural Research Service, and Agricultural Experiment Station, University of Nevada, Reno.

This progress report describes the allotment management and results of scientific investigations for the period October 1, 1982 through September 30, 1983. In addition, it provides a summary of organizational changes that have occurred since October 1, 1983.

Prior to November 1983, a steering committee was responsible for development of overall plans and actions needed to accomplish the study. This committee consisted of representatives from each Federal agency involved, as well as University of Nevada, College of Agriculture Cooperative Extension Service, Nevada Department of Wildlife, Nevada Cattleman's Association and the Saval Ranch owner and manager.

A new Memorandum of Understanding for the Saval Project came into effect on November 15, 1983. This Memorandum of Understanding established a policy-setting Executive Committee, a Scientific Team, a local Operations Team and an Advisory Committee. The position of Project Manager was also created. The Memorandum of Understanding and other material describing the present project organization are shown in Appendix I. The new Advisory Committee has not yet been chartered.

Common names of plants and animals are used in this report. Scientific names are given in Appendix II. The English system of measurement is also used. Factors to convert these measurements to metric units are presented in Appendix III.

A major and most welcome development over the past several months has been the increased interest on the part of University of Nevada faculty members and the Agricultural Experiment Station in undertaking affiliated research projects at the Saval Ranch.

One such project, "Cattle Grazing Behavior," was initiated late in the summer of 1983 by Julie Morrow, a graduate student in the Animal Science Department, working under the guidance of Dr. David E. Brown. The study site is located on the South National Forest pasture and will focus on

environmental influences on grazing behavior and cattle distribution. Factors to be examined include slope, season, and distance from salt and water. A study progress report is not available but will be produced in the next Project Progress Report.

Other proposed affiliated studies initiated after final Agricultural Experiment Station approval is received will be reported in subsequent years.

The scientific results and conclusions reported here are to be considered unpublished and preliminary in nature. They are presented to meet contractual agreements and to provide the supporting agencies and parties with a basis for judging progress. No results should be cited or quoted without permission from the authors.

ACKNOWLEDGEMENTS

Numerous people assisted the authors in the accomplishment of the 1983 fieldwork. Employees of the cooperating agencies included Denise Brock, Diana Goncalves, Joy Nishida, Mark Ports, Mike Rule and John Spencer. Volunteers provided by The Student Conservation Association, Inc., through its agreement with the Bureau of Land Management, were truly an asset to the project in 1983. Our thanks go to these individuals: Leslie Dubuc, Mike Gooch, Sandy Rancourt, Dave Robbins and Patricia Topley, and to the Association.

We also appreciate the continued cooperation of the ranch owners; of Saval Ranch Manager, Ralph Vance; and of the other ranch employees.

Lynn Winer Woodell provided some data used by the authors of Chapter 9. The editors also acknowledge the efforts of Gary Back to coordinate preparation of that chapter. Dr. Keith R. Cooley and other personnel of the Northwest Watershed Research Center, Agricultural Research Service, Boise, continue to assist and advise with hydrology and climatology studies.

The outstanding typing efforts of Dana Jensen, who was forced to take on this report so soon after being introduced to her new word processor, deserve recognition, as does the typing support from Jamie Peer.

Brock, Goncalves and Topley working in
Loamy 8-10" Range Site, Middle Mahala.
Photo by M. Gooch.

CONTRIBUTIONS OF THE SAVAL RANCH RESEARCH AND EVALUATION PROJECT[1]

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1. McAdoo, J. K. and D. A. Klebenow. 1979. Native faunal relationships in sagebrush ecosystems, p. 50-61. In Proc. of the Sagebrush Ecosystem Symposium. Utah State Univ., Logan, Utah.

2. Armstrong, R. M., C. R. Blincoe, C. F. Speth and D. R. Hanks. 1981. A comparison of lignin, acid insoluble ash and beryllium as internal ruminant digestion indicators. Proc., Western Section, Am. Soc. Animal Sci., 32:218-219.

3. Loomis, S. A. 1983. SPUR applications and limitations - Management, p. 111-116. In J. R. Wight (Ed.) SPUR - Simulation of Production and Utilization of Rangelands: A Rangeland Model for Research and Management. U.S. Dept. Agr. Misc. Publ. 1431.

4. Platts, W. S. and R. L. Nelson. 1983. Population fluctuations and generic differentiation in the Humboldt cutthroat trout of Gance Creek, Nevada. CAL-Neva Wildlife Transactions, 1983:15-19.

5. Torell, A. In Press. Economic value of crested wheatgrass: A case study. In Proc. Crested Wheatgrass Symp. Utah State Univ.

1 According to the publications policy adopted by the Executive Committee December 6, 1983, only publications that have undergone the approved review procedures and meet established criteria will be listed as project contributions. However, the Executive Committee has agreed that these publications, which were either printed or in press before the policy was approved, shall be listed as contributions.

PROFESSIONAL AND PUBLIC SERVICE ACTIVITIES

The purpose of this section is to describe and credit the efforts of personnel associated with the Saval Project to keep professional colleagues and the public informed about the project, its findings, and its accomplishments.

Made presentations and review of the Saval Project to the Cooperative State Research Service Review of the Range, Wildlife and Forestry Dept., UNR, Reno. Jan. 3-4, 1983. G. Back, D. W. Stager.

"Sage Grouse Nesting and Brood Habitats on the Saval Project" presented at the winter meeting, Nevada Chapter of The Wildlife Society, Las Vegas, NV. Jan. 7, 1983. M. Barrington.

"Wildlife use of Private Ranchland in the Great Basin," Nevada Chapter of The Wildlife Society, winter meeting, Las Vegas, NV. Jan. 7, 1983. J. K. McAdoo and M. R. Barrington.

Slide presentation on Saval research. Elko Kiwanis Club. Jan., 1983. J. K. McAdoo.

Short presentation on the Saval Project given at the annual meeting of the Nevada Section, Society for Range Management. Jan. 15, 1983. D. W. Stager.

Presentations on the Saval research given to visiting class from the University of Wyoming, Laramie. Mar. 12, 1983. G. Back, J. Barber, M. Barrington, J. K. McAdoo, D. W. Stager, L. W. Woodell.

Presentations on sage grouse life history and management, a review of the Saval sage grouse research, and on the integration of ruffed grouse, pulpwood, and nongame bird management to a University of Nevada, Reno, Upland Game Class. Also demonstrated field techniques for nightlighting sage grouse and conducting strutting ground counts; Elko. Apr. 16-18, 1983. G. Back, M. Barrington.

Conducted tour and made presentations on Saval research for University of Nevada, Reno's, Integrated Resource Management class. G. Back, M. Barrington, J. K. McAdoo, W. Stager, L. W. Woodell, J. Barber.

Saval Project representative at a U.S. Forest Service I.D. Team meeting regarding the Black Beauty Claim Mining Proposal; Elko. Sept. 13-14, 1983. G. Back, T. Dailey.

Papers:

Back, Gary N. and Mack R. Barrington. 1983. "The Saval Ranch Winter Habitat Study: A Progress Report." Presented 30 August, The Western States Sage Grouse Workshop, Ontario, OR. (Abstract).

Barrington, Mack R. and Gary N. Back. 1983. "The Saval Ranch Research and Evaluation Project: Sage Grouse Research - An Overview." Presented

30 August, The Western States Sage Grouse Workshop, Ontario, OR. (Abstract).

Eckert, R. E., Jr. (Editor). 1983. Progress Report for 1982. Saval Project. 129 p.

McAdoo, J. K., and D. A. Klebenow. February, 1983. Utilization of a new crested wheatgrass seeding by black-tailed jackrabbits. No. 251. In: Abstracts Presented at the 36th Annual Mtg., Soc. Range Manage., Albuquerque, N. Mex.

McAdoo, J. K., R. A. Evans and W. S. Longland. October, 1983. Responses of nongame wildlife to type conversion of sagebrush habitats. In: Symp. on Crested Wheatgrass: Its Values, Problems, and Myths. Logan, Utah. (Paper in press).

Torell, A. October 3-7, 1983. The economic value of crested wheatgrass: a case study. Symp. on Crested Wheatgrass: Its Values, Problems and Myths. Logan, Utah. (Paper in press).

W. S. Platts made the following presentations using or referring to his Gance Creek work:

1. Population Fluctuations and Genetic Differentiation in the Humboldt Cutthroat Trout of Gance Creek, Nevada. American Fisheries Society, Cal-Neva Chapter Meeting.

2. Compatibility of Livestock Grazing Strategies With Riparian Stream Systems. Pacific Northwest Range Management Short Course - Range Watersheds, Riparian Zones, and Economics.

3. Progress in Range Riparian-Stream Research at the Intermountain Station. American Fisheries Society, Bonneville Chapter.

4. Fisheries Research Activities. Society of American Foresters, Intermountain Section.

5. Livestock Grazing and Riparian Systems. Society for Range Management, Nevada Section.

6. Livestock Effects on Riparian Areas. BLM Idaho Wildlife and Fisheries Workshop.

7. Livestock Grazing Impacts. New Mexico State University Short Course in Principles of Wildlife Habitat Management in the Riverine Riparian Ecosystem.

8. Panel Participant - Riparian Area Management. Nevada Section Society for Range Management.

COORDINATED MANAGEMENT PLAN

Russell T. Dailey

Changes in Plan

One deviation from the Coordinated Management Plan for 1983 was allowed so that livestock could be turned out on the East Darling pasture on April 15, 1983, rather than on West Darling. This was done because the east pasture has east and southerly exposures and became snow-free at a much earlier date than the west side. Changes in the deferred rotation system have been proposed for both Forest Service pastures and BLM seedings, but these changes have not been formally accepted. A meeting of managers and scientists was held March 20, 1984, and proposed changes were agreed to at that time. This provides sufficient time to implement the changes while the project is still in the interim grazing system.

1983 Range/Wildlife Projects

Range and wildlife improvements during 1983 were limited to installation of four new cattleguards. These cattleguards were placed in Lower Sheep, Lower Mahala, and between Middle Mahala and Upper Mahala pastures on the primary roads. The new cattleguards will allow ease of access to researchers in addition to minimizing the likelihood of livestock straying through an open gate. No range projects were completed on either National Forest or private lands during 1983.

1983 Livestock Grazing Use

Livestock were turned onto the East Darling pasture on April 15. The West Darling pasture was originally scheduled for use at this date, but late snows made this inadvisable. The number of cows turned in at this time totalled 659. They grazed this pasture until May 2, 1983, removing a calculated total of 395 AUM's (Animal Unit Months) of forage, of which 93% (368 AUM's) was from Federal range. The remaining 7% consisted of what was adjudicated to be removed from private land within the pasture. During the period May 2-4 the herd was removed to private land on the Tremewan pasture for branding.

During May 4-9 the herd was placed on Lower Mahala pasture where they removed 136 AUM's of forage. Federal and private lands accounted for 126 and 10 AUM's, respectively. On May 9 the gates to Middle Mahala pasture were opened and cattle allowed to drift into this pasture. The cattle were allowed to graze on Middle Mahala until May 26. The cattle removed 344 and 26 AUM's of forage, respectively, from Federal and private range.

Upper Mahala pasture was grazed during the period May 20 to July 1 by the first calf heifers. They consumed approximately 172 AUM's of forage, of which 161 AUM's were Federal and 11 were private.

The main cow herd was moved onto Upper Sheep pasture on May 26. The range bulls had been turned out there on May 20. Bulls and cows remained on Upper Sheep until July 1 and removed 776 AUM's of forage of which 737 were Federal and 39 were private. The herd was moved onto National Forest land July 1 and remained until September 30. The cattle removed a total of 2,766 AUM's, of which 2,533 came from Federal range and 233 from private range. Movement of cattle from the south Forest Service pasture to the north pasture was scheduled for August 30, however, some groups were missed and a minimum of 50 head were observed on the south pasture in mid-September. Following removal from National Forest land, the main herd was moved onto the Lower Sheep Seeding beginning October 1 and remained there until November 16. They removed 1,098 AUM's of forage, with 1,043 AUM's coming from Federal range and 55 from private range.

A herd of cull animals was turned out on the Seeding Control pasture on June 4, remaining there until September 9 and removed 122 AUM's worth of forage, of which 113 were Federal and nine were private.

Total estimated forage removed from Federal and private pastures within Saval Project grazing system boundaries included the following:

BLM administered: 3309 AUM's
Forest Servicee administered: 2533 AUM's
Private inholdings: 410 AUM's.

CHAPTER 1

CLIMATOLOGY RESEARCH

John Barber

Climate Station No. 4

1983 Objectives

1) To document the climatic characteristics of the study area.

2) To provide a reference for extrapolation of resource data to other sites.

3) To provide climatic data input to other study disciplines.

1983 Accomplishments

A climatic monitoring network was installed on the Saval Ranch in 1978 (Fig. 1.1). The network consisting of 11 climate stations, was designed to account for the climatic variability due to topography, elevation, and storm patterns that occur on the study area. Elevations of the stations range from 5950 ft at Station 11 to 7820 ft at Station 9 (1981 progress report).

Data collection continued at all 11 stations in 1983 as scheduled. A loss of equipment due to theft at Station 2 in late July resulted in a loss of data on windspeed and direction, solar radiation, and dewpoint

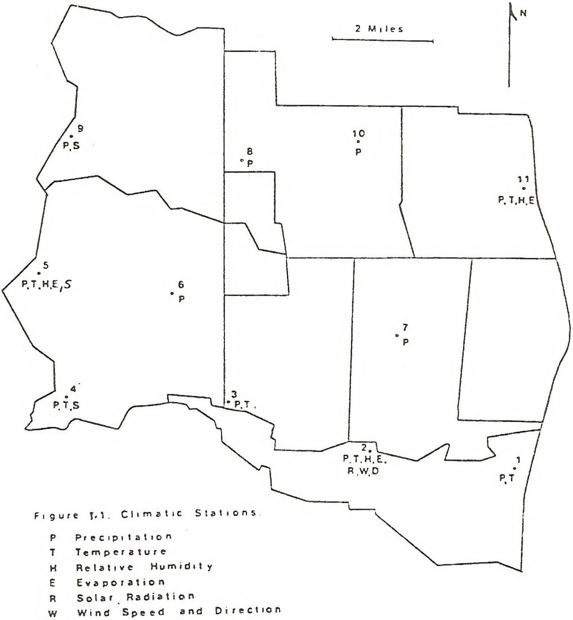

Figure I.1. Climatic Stations.

P Precipitation
T Temperature
H Relative Humidity
E Evaporation
R Solar Radiation
W Wind Speed and Direction
D Dew Point Temperature
S Snow Course

temperature from July through the remainder of 1983. Replacement equipment is presently being installed.

Precipitation gauges at all 11 stations were checked for calibration in the fall of 1983 by Agricultural Research Service (ARS) personnel from Boise, Idaho.

Precipitation gauges were installed at two existing flume sheds, one in Lower Mahala pasture and one in the native control pasture. Precipitation amounts at these two stations are recorded directly onto water level recording charts and digitized by the ARS personnel in Boise.

Precipitation

The 1983 Saval Calendar Year precipitation totals were estimated to be between 150 and 200% of normal for the area. Due to the lack of long term precipitation record on the Saval Ranch, this figure was estimated using data from two National Weather Service (NWS) climate stations located in Elko and Owyhee, Nevada, south and north of the project, respectively. According to the NWS, both the Elko and Owyhee stations were 150 to 200% of normal in 1983. From this information, the project was assumed to be in the same range of values.

Quarterly precipitation totals for 1983 Calendar Year and Water Year are listed for all 11 stations in Table 1.1. Water Year and Calendar Year totals are compared with the past 2 years of data in Table 1.2.

The average probability of an amount of precipitation occurring during a particular month or season is useful in planning range improvements and in generating long term records for management simulations and forecasting models. This type of data is available at Saval for all stations at any given amount of precipitation and period of time. For an example of this type of information, see the 1982 progress report; Climatology section.

During the calendar year 1983, there were several major storm events on the project. These storms produced over an inch of precipitation at various stations. Many of the major events occurred from the fall through the end of 1983. Individual storm depths, durations, and intensities have been calculated and are available for all stations for the years 1980 through 1983.

Elevation plays a major role in influencing the amount of precipitation on the project. Relatively small changes in elevation can produce a notable increase or decrease in total precipitation. The relationship of annual precipitation and station elevation is shown using regression in Fig. 1.2. Annual precipitation totals were based on averaging 1979 through 1983 Calendar Year totals at all stations except Station 6, which was moved in 1980. This relationship can be a useful tool for estimating precipitation at sites with elevations different than the climate station sites.

We are currently attempting to refine this relationship to increase our ability to extrapolate from data collected at the climate stations. The

Table 1.1. Precipitation totals for the Saval study area (in inches).

	Climatic Stations										
Quarter	1	2	3	4	5	6	7	8	9	10	11
1982-4	4.38	4.29	5.63	8.64	13.92	5.88	4.86	6.49	10.14	4.94	4.62
1983-1	4.89	4.48	5.82	9.59	13.53	6.18	5.05	6.27	10.36	5.17	4.75
1983-2	2.58	2.12	4.00	5.31	7.80	4.05	2.20	3.51	6.34	2.38	2.02
1983-3	3.86	3.47	3.62	4.33	3.61	4.20	3.31	3.81	4.08	3.76	2.60
1983-4	7.74	7.87	9.68	15.09	23.30	9.23	8.36	10.87	25.80	7.59	6.47
Water Year 1983 Total	15.71	14.36	19.07	27.87	38.86	20.31	15.42	23.89	30.92	16.25	13.99
Calendar Year 1983 Total	19.07	17.94	23.12	34.32	48.23	23.66	18.92	24.46	46.58	18.90	15.84

Table 1.2. Comparisons of Precipitation values at 11 stations for water and calendar years, 1981, 1982, and 1983 (in inches).

Station	Water Year 1980-1981	Water Year 1981-1982	Water Year 1982-1983	Calendar Year 1980	Calendar Year 1981	Calendar Year 1983
1	6.05	18.48	15.71	11.59	16.28	19.07
2	6.22	17.49	13.81	11.49	15.32	17.94
3	8.13	20.90	19.07	14.35	18.46	23.12
4	13.39	30.90	27.87	22.56	27.14	34.32
5	21.61	42.95	38.86	33.51	39.32	48.23
6	10.68	25.22	20.28	18.22	20.90	23.66
7	6.48	18.75	15.42	12.43	16.41	18.92
8	9.01	22.96	18.73	16.10	19.70	24.46
9	18.53	36.09	30.94	28.33	31.15	46.58
10	6.58	18.50	16.25	12.11	16.43	18.90
11	6.24	17.68	13.99	11.90	15.36	15.84

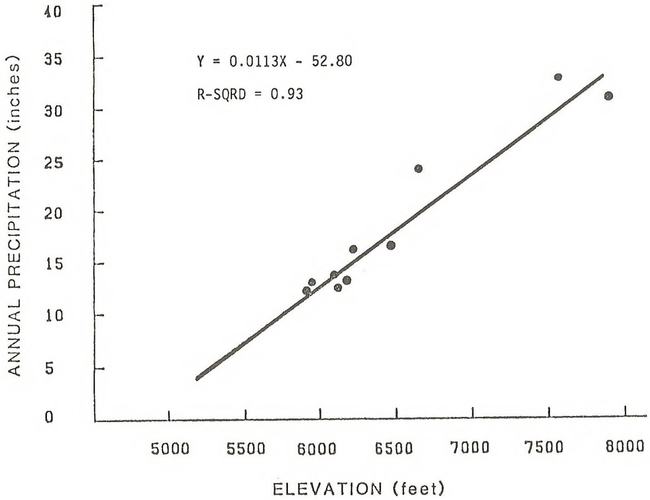

Figure 1.2. Regression of average annual precipitation as a function of elevation for 10 climate stations.

approach will take into account storm patterns as well as elevation to provide a more accurate estimate of precipitation for any site where precipitation data are needed.

Snowpack

Snowpack measurements were taken at three upper elevation climate station sites in 1983 (Fig. 1.1). Snow depth and water equivalent were measured approximately once every three weeks throughout the winter. Snowpack information is available on request. Future investigations using snowpack information will focus on snowmelt and stream flow relationships on the Saval to gain some insight into the interactions of these hydrologic processes.

Temperature and Humidity

Temperatures in Nevada vary primarily with elevation and secondarily with latitude (Court et al. 1980). On the Saval, the lower elevation stations record the extreme temperatures, while the upper elevation stations show much less diurnal and yearly variability. Summer highs range from 80 to near 100 at the lower elevation stations and 70 to low 90's at upper elevation stations. Winter low temperatures at lower elevation stations ranged from near 0 to -20 deg, while upper elegation minimums ranged from 10 deg to just below 0 deg. The 1983 maximum temperature of 99 deg was recorded in August, and the minimum temperature of -28 deg was recorded in February. Both the maximum and minimum temperatures on the project were recorded at Station 1, a lower elevation station. Monthly maximum and minimum temperatures for both the Water Year and Calendar Year for all six thermograph stations are listed in Table 1.3.

Above ground plant biomass in northeastern Nevada is assumed to depend primarily on temperature and soil moisture. The growth limiting effects of light and nutrients are considered to be negligible (Sonntag et al. 1982). Early in the growing season soil moisture is high, and nonlimiting to plant growth, while temperatures are low and more limiting. As the growing season progresses, soil moisture becomes the most limiting factor. Range plants in this type of environment have adapted to this stress by achieving most of their growth when the moisture needed for growth is high. As a result, low air temperatures early in the growing season, may have an effect on total production. One measure of the period available for plant growth due to temperature is the Growing Degree Days (GDD) (Court et al. 1980). This method assumes that a plant will not grow any faster with the average greater than 86 deg, and will not grow with an average below 50 deg. Thus, average daily temperature minus 50 deg yields the corresponding number of GDD's for that day, except that any average above 86 deg does not count more than 36 GDD's (i.e. 86-50). This allows for comparing growing seasons on the basis of temperature. GDD's at Station 2 in 1981 totaled 293 for the period March through June, when temperature was most limiting to growth, compared with 229 in 1982 and 241 in 1983 for the same periods. Using the data collected to the present on the project, (see 1981, 1982, 1983 progress reports; vegetation section), no direct relationship between air temperature and vegetative production can be established. Correlating air temperature, soil moisture, and vegetative production may provide a more

Table 1.3. Monthly maximum and minimum temperatures (°F).

	Climatic Stations											
	1		2		3		4		5		11	
Month	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
October 1982	69	9	65	13	65	16	65	14	80	22	89	26
November 1982	56	-4	56	0	56	5	55	2	51	7	56	-5
December 1982	46	-27	46	-22	48	-9	43	-8	41	5	45	-17
January 1983	47	-20	46	-10	48	-9	47	1	51	7	48	-15
February 1983	48	-28	54	-16	55	-5	48	-2	37		52	-18
March 1983	55	7	58	10	53	14	51	12			53	12
April 1983	63	12	62	10	60	15	57	12	48	13	62	13
May 1983	84	18	82	21	84	19	82	20	83	17	86	18
June 1983	84	25	84	27	80	29	78	28	74	29	84	24
July 1983	94	28	92	32	95	33	90	29	83	31	93	27
August 1983	99	34	98	38	98	45	93	39	88	42	99	36
September 1983	88	18	86	19	86	23	84	17	77	21	88	17
October 1983	72	18	71	21	72	25	71	22	66	24	75	16
November 1983												
December 1983												

meaningful relationship. Soil moisture has been recorded at various sites on the Saval using Gypsum blocks, but these provide a fairly broad range of values and are accurate only for a relatively short period of time. Other methods for measuring soil moisture more accurately are being considered for use on the Saval.

Three stations record relative humidity on the Saval Ranch (Fig. 1.1). Relative humidity is strongly influenced by atmospheric temperature. Therefore, averaging daily values would not provide for a useful representation. Humidity values are not provided here but are available. Winter minimum values commonly fluctuate between 30 and 40%, while summer lows of 10 to 20% are common. Values of 100% may occur in any season due to storm events or low air temperatures.

Evaporation

Standard National Weather Service Class A Evaporation pans were installed at Station 2 and Station 11 in 1981. Station 11 was upgraded in 1982 with an automatic evaporation system allowing for a more detailed monitoring of daily evaporation rates (1982 progress report).

Evaporation rates are not monitored all year on the project. In the winter, ice is formed on open bodies of water, and evaporation becomes negligable. Evaporation becomes important in the spring through fall when the highest evaporation rates occur and have the greatest effect on soil moisture and losses from open water.

Evaporation observations were made at Station 2 and Station 11 from June 6 to November 11. Evaporation totals for the period of observation were 35.34 inches and 30.48 inches at Station 2, and 11, respectively.

The mean evaporation rates for the operiod of sampling was 0.22 inches per day at Station 2, and 0.19 inches per day at Station 11. Multiplying pan evaporation amounts by the standard pan coefficient of 0.6 or 0.7 gives an estimate of evaporation from lakes or reservoirs.

Air temperatures have a major effect on evaporation rates. Fig. 1.3 demonstrates this relationship using data from Station 11.

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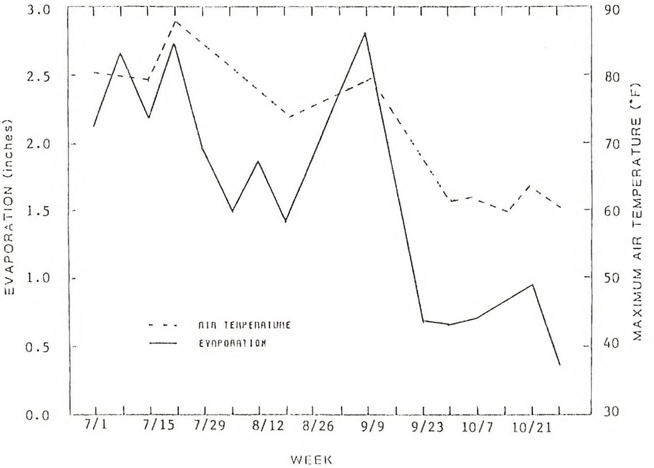

Figure 1.3 Weekly pan evaporation and average maximum air temperature at climate station 11 during 1983.

CHAPTER 2

HYDROLOGY

Karl Gebhardt

1983 Objectives

1. Reduce backlog of precipitation and climate data, and enter into computer data base.

2. Analyze Universal Soil Loss Equation rainfall simulation data.

3. Continue the collection of runoff and sediment and climate data.

4. Remeasure cross-sections on Mahala Creek and two reservoirs.

5. Collect runoff data from four small low-elevation watersheds.

1983 Accomplishments

1. FY 1983 was the first year that the Saval Project Hydrologist (Mr. Steve Loomis) was stationed in Boise, Idaho to coordinate the Saval and Reynolds Creek projects. Mr. Loomis transferred from the Denver Service Center (DSC) in August of 1982 to the Idaho State Office. In August, 1983 Mr. Loomis returned to Colorado to pursue a graduate degree in engineering. After being vacant for several months, the project hydrologist position has now been filled by Mr. Karl Gebhardt, formerly the Idaho State Office Hydrologist. However, Mr. Gebhardt has been really performing in two positions until the state hydrologist vacancy is also filled. Further, much attention has been focused on preparations for the Reynolds Creek Technology Transfer Symposium. Thus, a backlog of data reduction and analysis exists that will be dealt with in the coming months.

2. A substantial amount of backlogged data was entered into the ARS computer system in preparation for electronic transfer to other computer facilities such as DSC Honeywell 6640 and State Office's Level 6.

3. Infiltration data were analyzed in conjunction with data collected at Reynolds Creek for development of the Universal Soil Loss Equation for Rangelands. (Presentation and paper prepared, participated in BLM/ARS USLE workgroup)

4. Instantaneous discharge and suspended sediment samples were collected and a computer program written to process the data.

5. Continuous discharge stations were operated on Gance and Mahala Creeks (2 locations each).

6. A resurvey of Mahala Creek was conducted in late summer to document channel changes caused during spring runoff. Two small reservoirs

were surveyed to better quantify sediment yield.

7. Runoff data were collected from four small low-elevation watersheds. Data were not completely reduced, however.

8. Participation in the Saval integration and synthesis model expanded to include fisheries-riparian impacts.

9. ARS personnel from Boise assisted in field calibration of all precipitation gages, repair of Wyoming shields, and installation of precipitation gages and recorders at the two H flume small watershed sites.

Data Summary

Table 2.1 presents a summary of physical data that have been collected by the Saval Project. Some of the data has been reduced while other data are still on field sheets in an unreduced format. Some data are available on computer printout or tape.

HYDROLOGY PROSPECT STATUS AND FINDINGS

The following will describe some of the major areas of research, their status, output products that have been produced or are close to being produced, proposed changes of emphasis or approach, and management implications.

Erosion Prediction - Universal Soil Loss Equation (USLE)

As described in the 1982 progress report, the Saval site was used in conjunction with Reynolds Creek in developing USLE plot data for improving the USLE for use on rangelands. Results of the work showed that the soil erodability factor (K-factor) determined from the soil erodability nomograph (Wischmeier and Smith, 1978) agreed quite well with, but were consistently 20% greater than, the K-factor calculated from actual erosion plot data. This is a very positive finding for users of the USLE since a fairly reproducible procedure can be used to estimate a K-factor.

Therefore, those using soil survey data should make field determinations before applying the published K-factors from a soil survey. All of the nomograph-determined K-factors used actual soil samples of the upper 2.5 cm of the profile. Unfortunately, the research also showed a poor correlation of soil loss on the sagebrush and shadscale rangeland sites with the cover management factor "C" for sites with a wide range of bare ground, canopy cover, and depression storage. Johnson et al. (1983) suggest "Further study to evaluate effects of ground and canopy cover, roots, and depression storage on rangeland is needed before sagebrush rangeland soil loss prediction will be greatly improved." The study also concluded that the subfactor procedure provides reasonable cover-management factor estimates for grazed sites.

Based on this research in northern Nevada and southwestern Idaho the following general recommendations can be made about the USLE:

Table 2.1. Summary of Climatologic and Hydrologic Data.

Category	Type/ Frequency	Stations/ Descriptions	Period of Record	Format	Where Available
Precipitation	BP,D,M,A	11 sites	1980-present	CP,CT,C	Elko, Boise
Temperature	C,Max-Min	6 sites	1979-present	CP,CT,C	Elko, Boise
Relative Humidity	C	3	1979-present	C	Boise
Wind (Speed, Dir.)	C	1	1979-present	C	Elko
Evaporation	C,N	3	1980-present	C,F,R,	Elko
Solar Radiation	C	1	1980-present	C	Elko
Snow Course	V	2	1980-present	F,R	Elko
Dew Point Temp	C	1	1980-present	C	Elko
Soil Moisture	V	Unknown	1982-present		Elko
Suspended Sediment	DI	31 sites			Elko, Boise
Suspended Sediment	C,V		1981-present	F,R,CP	Elko, Boise
Water Quality	V-major cations, animal nutrients			F,R	Elko, Boise
Discharge	B-P,D,M,A I		1979-present	CP,CT,C CP,F	Elko, Boise Elko, Boise
Infiltration Plots	35'x10' plot size		Sept. 1982	CP	Boise
	Runoff		Sept. 1982	CP	Boise
	Sediment		Sept. 1982	CP	Boise
Erosion Index	per storm, cumulative		1980-present	CP	Boise
Soil Survey	order 1 order 3		1981	Report	Elko, Boise
Channel and Stream Stability Surveys		All major creeks over 250 data sheets	1979	F	Boise

BP = Breakpoint
D = Daily
M = Monthly
A = Annual
C = Continuous

V = Variable
W = Weekly
DI = Depth Integrated
I = Instantaneous

CP = Computer Printout
CT = Computer Tape
C = Chart
F = Field Sheet
R = Reduced Sheet

1. The USLE appears to predict soil loss based on textural soil information (USLE nomograph, K-factor) of tilled plots quite well. This means that the K-factor determination is reproducible and capable of discriminating soil erodability from a textural standpoint.

2. There was a poor correlation between observed soil loss and predicted soil loss using cover-management subfactors for undisturbed plots. Therefore, before applying the USLE to obtain absolute values, more has to be done to explain the observed variation in the data. In other words, the cover-management subfactors failed to predict the measured soil loss consistantly, so they should be used cautiously.

3. The cover-management subfactor procedure performed reasonably well on grazed sites. Therefore, it seems reasonable to assume that comparisons within a particular site could be made relative to changes in the cover-management subfactor.

Effects of Grazing Management Systems

An original objective of the Saval project was "to evaluate the effects of an intensive livestock/grazing management system on the processes and response of the hydrologic system." This objective applies to several areas: the upland watershed area, and the stream channel or riparian area. To evaluate these areas there needs to be a thorough understanding of the hydrologic processes taking place. These processes can be thought of as: water quality and timing responses, water quality responses, riparian erosion responses (sedimentation) and upland erosion responses. All of these responses can be attributed to the effects of nature and the effects of management. To evaluate the effects of management, the natural responses must be describable at a certain level of certainty. Once that level of certainty for the natural effects are established, then some idea of the degree of change necessary to measure the effects of management can be estimated. If the degree of change is measurable, then some conclusions regarding management effects can be made.

The hydrology phase of the Saval research is to the point where levels of certainty must be established for the different responses. These levels will have all types of "strings attached" or such as: adequate controls, conclusions within a given range of values, provisions that "such-and-such" remains constant, etc. Such descriptions are necessary to maintain the integrity of findings.

The proposed approach for future hydrology research is to:

1) Continue past data collection;

2) Analyze data sets to establish levels of certainty;

3) Identify more specific objectives that relate to grazing management systems and hydrologic response;

4) Determine which objectives are technically feasible to attain with present data collection efforts and which are not;

5) Define which objectives cannot be met and why;

6) Take remedial actions or discontinue certain data collection efforts.

Technological Research and Development

Rangeland watershed technological development is in its infancy across the western United States after many years of data collection. Several major rangeland research centers are now beginning to develop tools that will be helpful to the resource manager. These tools include computer models such as the Ekalaka Rangeland Hydrology and Yield Model (ERHYM), the Simulation of Production and Utilization on Rangelands (SPUR), the Erosion Productivity Impact Calculator, the Small Watershed Model and many others. Other tools include vegetation cover measurement procedures, frequency frame procedures, erosion prediction, etc. There are few areas where such tools can be developed and tested. The Saval research project is such an area. The past several years of research at Saval Ranch have been involved with the ERHYM and SPUR models, remote sensing projects, testing of sampling techniques, and sampling devices.

The research and development approach for the hydrology projects will be to:

1) Continue to test and develop methods that improve the efficiency of watershed management in the Bureau;

2) Keep current on new technological advances;

3) In cooperation with the Nevada State Office and Denver Service Center prepare reports that will be useful to the field.

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CHAPTER 3

VEGETATION RESEARCH

D. Waive Stager and Richard E. Eckert, Jr.

Species Composition

1983 Objectives:

1. Establish additional transects and reread old transects to determine species frequency and ground cover characteristics on various upland and riparian range sites.

2. Continue sampling for density and cover of tree and shrub species on new and previously established transects.

3. Initiate sampling of basal and foliar cover of shrubs, grasses, forbs, and of ground cover on selected monitoring sites using a point intercept method.

1983 Accomplishments:

Methods. In 1983, 12 additional frequency and ground cover transects were established: six in Lower Sheep Creek seeding, one in Upper Sheep Creek pasture (in conjunction with a rodent grid), one in Middle Mahala pasture, and four in the North National Forest (NNF) pasture. Transects established in 1980 on three wet meadow sites were reread. Frequency of occurrence was determined on 10 transects of 20 quadrants each. Quadrat size varied from 3 x 3 in. to 20 x 20 in., depending on plant density. Living and non-living ground cover was determined from 600 points per site. A schedule for rereading all transects has been established: once every 3 and 4 years for the Wet Meadow Range Site on BLM and NF pastures, respectively, and once each 4 and 6 years for all other range sites and seedings on NF and BLM pastures, respectively. Methods and results for vegetation sampling in the Lower Sheep Creek seeding are reported in the "Species Composition" section of Chapter 9, "Evaluation of the Lower Sheep Creek Seeding".

Fifteen previously established frequency transects were sampled for basal area and foliar cover of shrubs, grasses, forbs, and for ground cover characteristics using a point intercept technique. This technique uses two superimposed wire grids, mounted on three adjustable tripod legs to produce a sighting grid of 36 points. This double-sighting point frame casts a dot-grid on the underlying vegetation or ground, and "hits" at each point are recorded. Samples were collected at 3.3 ft. intervals along a 100 ft. transect. The point frame was centered at each sample point over a taut steel tape, leveled, read, and data recorded.

Results. We had planned to reread frequency transects on five examples of the Wet Meadow Range Site, however, grazing by trespass cattle prevented collection of data on two meadows. Transects on the other three meadows were among the first sampled in 1980. Several problems with original data collection preclude any positive statements about changes in plant composition

since 1980. First, quadrat lines were marked at only one end. Lines sampled ran approximately at 90° to the base line. In rereading, it became obvious that species presence or absence is so variable that a very large number of random-directional lines would be required for an adequate sample. To correct this problem, each transect line was marked at both ends so that exactly the same line of quadrats will be sampled in future years. Second, species of rush, sedge, and cinquefoil could not be adequately identified. This problem was corrected by part-time employment of a qualified plant taxonomist. Third, identification was made only by reproductive parts. We believe that transects established in 1980 will have to be read twice in order to solve these sampling and identification problems.

Information on changes in vegetation composition and ground cover characteristics based on an adequate sample of the allotment as a whole can be used by other disciplines to interpret reasons for changes in their resource values over time. The land manager can use this information to determine if a significant change in vegetation or ground cover has occurred. He can then determine if a change in range condition has occurred, and whether this change represents an upward or downward trend in range condition, based on management objectives for a range site or for the allotment. Agencies can also use this information to evaluate the adequacy of their sampling intensity on other allotments.

Basal cover of shrubs, grasses, forbs, and ground cover chacteristics (Table 3.1) and foliar cover of shrubs, grasses, and forbs (Table 3.2), can be used for different purposes. Foliar cover, basal cover, and ground cover were collected on examples of important range sites where frequency data are also collected. Foliar cover was determined for its possible use in hydrology modeling, in rainfall simulation studies, and as an indication of leaf-area index. Changes in vegetation composition measured by basal-area cover, a conventional but very time consuming technique, can be used to validate changes in vegetation composition as determined by the relatively new frequency technique. Frequency will be widely used by land management agencies for monitoring vegetation change because it provides a statistically adequate sample for a smaller expenditure of funds.

Production

1983 Objectives:

1. Measure herbaceous production on the Darling crested wheatgrass seeding.

2. Measure herbaceous production on range sites in Middle Mahala pasture to provide information on food availability for sage grouse.

1983 Accomplishments:

Methods. Herbaceous production was measured on the West Darling crested wheatgrass seeding and on four range sites in Middle Mahala pasture. Production data were collected using methods described in the 1982 Saval Progress Report.

Table 3.1. Mean percent basal cover of shrubs, grasses, forbs, and ground cover characteristics on selected range sites determined by the Point Intercept Technique.

					Ground Cover Characteristics*					
Range Site or Seeding	Pasture	Shrubs	Grasses	Forbs	BG	NP	PL	Rock	Pave	Crypt
Crested Wheatgrass Seeding	West Darling	T**	12	T	37	41	3	T	8	0
	West Darling	1	14	0	23	45	6	T	11	0
Loamy 8-10"	Lower Mahala	T	4	0	33	25	11	T	27	0
	Middle Mahala	2	7	2	29	38	13	0	10	T
Claypan 10-12"	Mahala Control	4	9	1	13	32	5	0	35	T
	Upper Mahala	3	6	T	14	38	12	T	27	0
Loamy 10-12"	Mahala Control	6	10	2	21	46	10	T	3	1
Dry Meadow 10-16"	North National Forest (NNF)	1	15	2	15	60	5	1	2	0
Loamy Slope 10-16"	NNF	1	13	1	29	47	8	1	1	0
	NNF	2	8	T	6	51	19	1	13	0
Claypan 12-16"	NNF	4	2	1	16	34	6	T	36	0
Aspen Woodland	NNF	T	1	1	26	57	10	T	5	0
South Slope 12-14"	South National Forest	1	3	T	1	51	7	1	35	T
Steep North Slope 16+"	NNF	1	14	9	14	49	5	4	4	0
Mt. Ridge 16+"	NNF	1	6	2	4	9	2	1	75	0

*Ground Cover Characteristics

BG = Bare ground
NP = Non persistent litter
PL = Persistent litter
**T = Trace = $\leq$ 0.5%

Rock = Rock
Pave = Pavement
Crypt = Cryptogam

Table 3.2. Mean percent canopy cover of shrubs, grasses, and forbs on selected range sites determined by the Point Intercept Technique.

Range Site or Seeding	Pasture	Shrubs	Grasses	Forbs	Total
Crested Wheatgrass Seeding	West Darling	3	30	T*	33
	West Darling	5	42	0	47
Loamy 8-10"	Lower Mahala	9	14	T	23
	Middle Mahala	25	14	2	41
Claypan 10-12"	Mahala Control	18	31	1	50
	Upper Mahala	22	13	T	35
Loamy 10-12"	Mahala Control	33	20	2	55
Dry Meadow 10-16"	North National Forest (NNF)	8	41	5	54
Loamy Slope 10-16"	NNF	14	32	9	55
	NNF	30	19	1	50
Claypan 12-16"	NNF	15	25	1	41
Aspen Woodland	NNF	18	7	7	32
South Slope 12-14"	South National Forest	13	17	8	38
Steep North Slope 16+"	NNF	15	22	20	57
Mt. Ridge 16+"	NNF	4	18	4	26

*T = Trace = $\leqslant$ 0.5%

Results. Crested wheatgrass production on the West Darling site was 702 lb/ac on July 20. Based on phenology records, this was probably close to peak production (seed ripe) for this site. Using BLM phenology adjustment factors on data taken in 1981 and 1982 on this site, peak production was estimated at 337 lb/ac and 633 lb/ac, respectively, for these 2 years. Growing season precipitation (September through June) was 6 inches in 1981 and 14 inches in both 1982 and 1983.

Herbaceous production on range sites in Middle Mahala pasture was determined primarily to provide information on food availability for sage grouse. The sage grouse section of this report will discuss these results. Some production data taken on these sites during the 1982 and 1983 growing seasons will be compared in this section.

The Loamy 8-10", Loamy 10-12", and Claypan 10-12" Range Sites were sampled on approximately the same dates in 1982 and 1983. Total herbaceous production and grass production was significantly ($P < .05$) greater in 1983 than in 1982 (Table 3.3). Total production was 80% higher in 1983 on the two loamy sites and 150% higher on the claypan site. Only Sandberg bluegrass contributed to the increase in yield on the Claypan and Loamy 8-10" sites. Bluegrass, squirreltail, and cheatgrass contributed to the increased yield on the Loamy 10-12" site. Production of forbs was significantly greater in 1983 only on the Claypan site. Species responsible for the yield increase were tailcup lupine and Hood's phlox. Production on the Dry Meadow 10-16" Range Site was not significantly higher in 1983. However, the sample date in 1983 (June 20) was 11 days earlier than in 1982. Since production was greater on June 20, 1983 than on July 1, 1982, we suspect that the difference in estimated peak production in 1983 compared to 1982 would have been significant had the sample been taken at a later date. Growing season precipitation in Middle Mahala pasture was 20% higher in 1983 than in 1982. This was the second season of above average precipitation after below average precipitation in 1981. The 2 consecutive years of above average precipitation plus even higher precipitation this year than last probably contributed to the higher herbage production in 1983. Protection of these sites from grazing for 2 years may have also contributed to increased plant vigor, although grazing outside the exclosures has been fairly light the past couple of years.

We now have 3 years of production data from various range sites on the Saval Ranch. These data will be used with the ERHYM model[1/] to test this method of predicting herbaceous production using Saval's climatology data. These predictions may be used in the Saval integration model.

Utilization

1983 Objective:

Estimate species utilization on major range sites at the end of respective grazing periods and at end of the growing season.

[1/]Wight, J.R. and E.L. Neff. 1983. Soil-vegetation-hydrology studies, Volume II. A user's manual for ERHYM: The Ekalaka Rangeland Hydrology and Yield Model. USDA/ARS, Agric. Research Results. ARR-W-29. 38 pages.

Table 3.3. Mean herbaceous production on four range sites in the Middle Mahala pasture on selected dates during the 1982 and 1983 growing season.

Range Site	Sampling Date	Grasses	Forbs	Total
		Lb/ac		
Loamy 8-10"	6-28-82	142^{b}	121	263^{b}
	6-28-83	304^{a}	176	480^{a}
Loamy 10-12"	6-30-82	187^{b}	132	319^{b}
	7-06-83	484^{a}	100	584^{a}
Claypan 10-12"	6-25-82	123^{b}	95^{b}	218^{b}
	6-29-83	252^{a}	291^{a}	543^{a}
Dry Meadow 10-16"	7-01-82	515	262	777
	6-20-83	570	282	852

[1]Mean production of grasses and forbs and total production <u>within</u> each range site followed by different letters are significantly different ($P < .05$) as determined by Duncan's multiple range test.

1983 Accomplishments:

Methods. The "Key Forage Plant Method" was used to estimate forage utilization at the end of the grazing and growing seasons on frequency transects and on other sample areas of different range sites. These estimates were used to identify cattle preferences among range sites, changes in species and range site preferences over the grazing season, differences in species and range site preferences among years, and impact of grazing on plants as indicated by residual use at the end of the growing season.

Results. Cows grazed the East Darling (ED) pasture from April 15 to May 2. Use was light (21-40%) at the end of the grazing period (Table 3.4). Crested wheatgrass in early leaf was the primary species grazed. Use on the ED and West Darling (WD) pastures in 1982 was severe (81-100%) when grazed at about the same time as this year. Lighter use in 1983 was due mostly to a reduction in the Saval cow herd from 972 to 659 animals and perhaps in part due to increased production in 1983. Only 396 AUM's of forage were taken this year from the ED pasture compared to 1040 AUM's taken from the ED and WD pastures last year (BLM actual use records). This is about a 58% reduction in grazing use. This year, as last, regrowth and seed production by crested wheatgrass after grazing was excellent due to abundant available soil moisture. Due to this regrowth, utilization at the end of the growing season was slight.

Lower Mahala (LM) pasture was grazed from May 4 to May 9. Use was moderate (41-60%) on all sites except the Loamy 8-10" Range Site, which received slight (1-20%) use (Table 3.4). From May 10 to May 26, cattle grazed Middle Mahala (MM) pasture. Use was slight on the Loamy Bottom Range Site, light (21-40%) on the Claypan 10-12" Range Site, and moderate on all other range sites. Nevada bluegrass on Wet Meadow and Loamy Bottom Range Sites received heavy use (61-80%)(Table 3.5) in both pastures. Sedges and rushes had moderate use in MM pasture. These species comprise only a small part of cattle diet in the lower pastures because the wet meadows in which they grow are rare. Sandberg bluegrass, a common upland species in both pastures, received moderate use. This species is the earliest developing grass on the Saval Allotment. Over the past 3 years, it has been the most utilized upland grass while in early leaf to prebloom or bloom phenology stages. This preference may be for the plant itself, or simply a reflection of its relative abundance in early spring.

About 125 cows (mostly replacement heifers) grazed Upper Mahala (UM) pasture from late May to the end of June. Use of range sites in this pasture was slight, except on the Wet Meadow Range Site, which received light use (Table 3.4). Great Basin wildrye and Nevada bluegrass in early leaf to bloom phenology stages were the most used species (Table 3.5). From mid-May to the end of June, most of the cow herd grazed in Upper Sheep Creek (USC) pasture. The Wet Meadow and Loamy Slope 10-14" Range Sites received moderate use, while the Loamy 10-12" and Claypan 12-16" Range Sites received light use (Table 3.4). Use on other range sites was slight.

Spike fescue, an infrequent species in USC pasture, was severely used during this grazing period (Table 3.5). Rushes, Nevada bluegrass, Great Basin wildrye, and Thurber needlegrass received light to moderate use. These species were in early leaf to bloom phenology stages during the grazing period. Moderate use and regrowth after grazing on all Mahala pastures and on USC pasture resulted in slight to moderate use on most species as measured at

Table 3.4. Vegetation utilization by cattle on range sites on the Saval Allotment pastures for the 1983 grazing season.

Range Site	East Darling (4-15 to 5-2)[1]	Lower Mahala (5-4 to 5-11)	Middle Mahala (5-9 to 5-26)	Upper Sheep (5-20 to 6-29)	Upper Mahala (5-20 to 7-1)	South National Forest (7-1 to 8-16)	North National Forest (8-16 to 10-20)
Crested wheat seeding	2+[2]	–[3]	–	–	–	–	–
Loamy 8-10"	–	1+	3	1	0	–	–
Claypan 10-12"	–	3–	2	1	1–	–	–
Loamy 10-12"	–	3+	3–	2	1–	–	–
Loamy Slope 10-16"	–	–	–	3	1	3	2–
Loamy Bottom 8-14"	–	3	1–	1	–	–	–
Claypan 12-16"	–	–	–	2–	–	3	1
Wet Meadow 10-16"	–	–	3	3+	2–	5–	4
Dry Meadow 10-16"	–	–	–	–	–	4–	1+
South Slope 12-14"	–	–	–	–	–	2–	1
South Slope 14-18"	–	–	–	–	–	3	1+
Loamy Slope 16+"	–	–	–	–	–	1	1–
Steep North Slope 16+"	–	–	–	–	–	0	0
Aspen Woodland	–	–	–	–	–	4	2
Mt. Ridge 16+"	–	–	–	–	–	1–	1–
Snow Pocket 16+"	–	–	–	–	–	1–	–

[1] Grazing period.

[2] Utilization cases:
0 = No use = 0%
1 = Slight = 1-20%
2 = Light = 21-40%
3 = Moderate = 41-60%
4 = Heavy = 61-80%
5 = Severe = 81-100%
+ or – indicates use was at the high or low end of a class

[3] Range site not present.

Table 3.5. Utilization by cattle of common species on the Saval Allotment pastures for the 1983 grazing season.

Species	East Darling (4-15 to 5-2)[1]	Lower Mahala (5-4 to 5-11)	Middle Mahala (5-9 to 5-26)	Upper Sheep (5-20 to 6-29)	Upper Mahala (6-2 to 7-1)	South National Forest (7-1 to 8-16)	North National Forest (8-16 to 10-20)
Crested wheatgrass	2+[2]	-[4]	-	-	-	-	-
Sandberg bluegrass	-	3	3+	1	1-	0	1
Bottlebrush squirreltail	-	1-	1-	1+	1+	1	0
Thurber needlegrass	-	1+	0	2-	1	-	-
Webber ricegrass	-	1+	1+	1+	0	-	-
Great Basin wildrye	-	-	1	2+	2+	2+	1
Bluebunch wheatgrass	-	-	-	1+	1-	2-	1+
Spike fescue	-	-	-	5	-	3-	1+
Idaho fescue	-	-	-	1	0	1+	1+
Needlegrass sp.	-	-	-	0	-	1-	-
Mountain brome	-	-	-	-	-	0	1-
Nevada and Kentucky Bluegrass[3]	-	4	4-	2+	2-	4-	3+
Sedge	-	1	3	1	1+	3-	2-
Rush	-	-	2+	3	1+	3-	2-
Antelope bitterbrush	-	-	-	1	0	3	2

[1]Grazing period

[2]See Table 3.4 for utilization classes

[3]Nevada bluegrass on BLM pastures.

Mainly Kentucky bluegrass on NF pastures.

[4]Species not present.

the end of the growing season. The exception was spike fescue in USC pasture. Use was severe on this species, and little or no regrowth occurred because grazing on this pasture continued until the end of June.

Grazing grasses from early leaf to bloom phenology stages is beneficial to cattle, but detrimental to plants. When phenology approaches bloom stage, plants are productive, and herbage is ideally balanced in minerals, vitamins, proteins, carbohydrates, roughage, and moisture for livestock gain. However, grazing can be harmful to plants when carbohydrate reserves are at a minimum. This occurs about the time flower stalks are showing. The Saval Management Plan was designed to minimize any harmful effects of use during this time through a stocking rate to achieve moderate utilization during the grazing period and by providing for complete rest in the year following late spring grazing.

About July 1, cows were moved from USC and UM pastures to the South National Forest (SNF) pasture. In mid-August, most of the herd was moved into the North National Forest (NNF) pasture, where they grazed until early October. Use on Wet Meadow, Dry Meadow, and Aspen Woodland Range Sites was heavy to severe in the SNF (Table 3.4). The South Slope 14-18", Claypan 12-16", and Loamy Slope 10-14" Range Sites received moderate use. After mid-August in the NNF, use was heavy on the Wet Meadow Range Site and light on the Aspen Woodland and Loamy Slope 10-14" Range Sites.

Generally in 1983, as over the past 4 years, utilization on range sites in the early summer-use pasture has been higher than on the same range sites in the late summer-use pasture. However, utilization in the late summer-use pasture was lighter this year than last. Lower utilization was probably due to both the reduction in herd size, and to an increase in forage production this year, as was reported on BLM range sites in the production section of this report. The most heavily grazed species in the SNF were meadow bluegrass, mostly Kentucky, (Table 3.5). Other species used during the same period were antelope bitterbrush, spike fescue, sedges, rushes, Great Basin wildrye, and bluebunch wheatgrass.

Most grasses in the SNF were in prebloom or bloom stages when cattle were turned in on July 1, and either reached seed-ripe or cast seed by the end of the early-summer grazing period. As on BLM pastures, the management plan for NF pastures also attempts to mitigate any negative effects of grazing when carbohydrate levels in plants are low. Negative effects are reduced because plants grazed during a critical growth stage in one year are deferred until seed ripe the following year. This practice is probably more effective on upland species that receive moderate use than on wet meadow species that receive heavy to severe use.

In the NNF, use on the above species was lower than in the SNF (Table 3.5). Use on meadow bluegrasses was highest of all species grazed. Grasses were mature (seed-ripe) or had already cast their seeds when cattle moved to this pasture. Utilization measured at the end of a grazing period on both NF pastures would be indicative of utilization determined at the end of the growing season because the growing season terminated before use estimates were made. Cattle probably maintained a high level of nutrition while grazing the early-use (SNF) pasture. However, the level of nutrition in the late-use (NNF) pasture was probably much lower since most forage species had matured

before cattle grazed there. Cattle nutrition research is needed to quantify any difference in nutritive value of forage in the early- and late-use pastures.

Using the past 4 years of utilization estimates, the relative preference of cattle for various forage species over the grazing season can be indicated (Tables 3.6 and 3.7). Preferences for the various species changed over the season, possibly in relation to phenology stages. Meadow bluegrasses (mainly Nevada on BLM pastures and mainly Kentucky on NF pastures) were the most preferred species throughout the grazing season. From late May to the end of the season, sedges and rushes were also highly preferred. These species are all found on the Wet Meadow Range Site. Sandberg bluegrass, a very common species on the Saval, is a very early growing species and is preferred by cattle while in early leaf to prebloom or bloom stages. As Sandberg bluegrass matures, other species (i.e. Thurber needlegrass, Webber ricegrass, and Great Basin wildrye) are more preferred. This switch in preference may be due to:

1. Sandberg bluegrass declining in palatability as it matures to bloom and seed-ripe stages,

2. palatability of other species increasing as they near prebloom, bloom, or dough phenology stages, or

3. the change in relative amounts of Sandberg bluegrass and other species available for grazing. Early in the season, Sandberg bluegrass is the most abundant forage source, since it starts growth before other forage species. Later in the season, herbage of other species is more abundant and available for grazing.

Spike fescue, Great Basin wildrye, and antelope bitterbrush are preferred species throughout the summer grazing season. Spike fescue seems to be a very desirable species at any phenology stage, even cured. However, it is not a very common species in any pasture. Great Basin wildrye seems to be preferred by the cattle from prebloom to the end of the grazing season. Use on antelope bitterbrush appears to start before bloom and continues through the grazing season. Work with fistulated steers showed that highest use on bitterbrush occurred after a pasture had been grazed by the main cow herd in both the early or later summer grazing periods. When a pasture was sampled before it was grazed by the main herd, most use was on wet meadow species. From this, we can speculate that use on bitterbrush starts when more preferred meadow species are less available due to heavy or severe use.

Table 3.6. Relative preference (based on utilization estimates) of cattle for forage species in various phenology stages on BLM native range.

Species	Phenology (early May - late May)	Species	Phenology (late May - late June)
Nevada bluegrass (1)*	Early leaf to prebloom	Nevada bluegrass (1)	Prebloom to mature
Sandberg bluegrass (2)	Early leaf to prebloom or bloom	Rushes (2)	Early leaf to bloom
Webber ricegrass (3)	Early leaf	Sedges (3)	Early leaf to bloom
		Thurber needlegrass (3)	Prebloom to bloom or dough
		Webber ricegrass (3)	Early leaf to dough
		Great Basin wildrye (3)	Early leaf to prebloom
Rushes (4)	Early leaf	Sandberg bluegrass (4)	Prebloom or bloom to seed ripe
Thurber needlegrass (4)	Early leaf to prebloom	Bottlebrush squirreltail (4)	Early leaf or prebloom to dough or seed ripe
Sedges (5)	Early leaf to prebloom	Bluebunch wheatgrass (5)	Early leaf to prebloom
Bottlebrush squirreltail (5)	Early leaf to prebloom	Idaho fescue (5)	Early leaf to bloom
Great Basin wildrye (6)	Early leaf	Antelope bitterbrush (6)	Early leaf to bloom

*(Preference Level)

1 = 1st

2 = 2nd

3 = 3rd

4 = 4th

5 = 5th

6 = 6th

Table 3.7. Relative preference (based on utilization estimates) of cattle for forage species in various phenology stages on NF native range.

Species	Phenology (late June - mid Aug.)	Species	Phenology (mid Aug. - late Sept.)
Meadow bluegrasses (mainly Kentucky) (1)*	Bloom to seed cast	Meadow bluegrasses (mainly Kentucky) (1)	Seed cast to cured
Sedges (1)	Bloom to seed cast	Sedges (1)	Seed cast to cured
		Rushes (1)	Seed cast to cured
Rushes (2)	Bloom to seed cast	Spike fescue (2)	Seed ripe to seed cast
Antelope bitterbrush (2)	Bloom to seed cast		
Spike fescue (3)	Bloom to seed cast	Antelope bitterbrush (3)	Seed cast
Great Basin wildrye (3)	Prebloom to seed ripe		
Bluebunch wheatgrass (4)	Prebloom or bloom to seed ripe	Great Basin wildrye (4)	Seed ripe to cured
Idaho fescue (4)	Prebloom or bloom to seed ripe	Bluebunch wheatgrass (4)	Seed ripe to cured
		Idaho fescue (4)	Seed ripe to cured
Mountain brome (5)	Prebloom to seed ripe	Mountain brome (5)	Seed ripe to cured
		Sandberg bluegrass (5)	Cured to fall greenup
Bottlebrush squirreltail (6)	Bloom to seed ripe	Bottlebrush squirreltail (6)	Seed ripe to cured
Sandberg bluegrass (6)	Seed ripe to cured		

*(Preference Level)

1 = 1st

2 = 2nd

3 = 3rd

4 = 4th

5 = 5th

6 = 6th

Secondary Succession

1983 Objectives:

1. Identify the factors influencing secondary succession.

2. Initiate research to quantify the influence of these factors on secondary succession.

1983 Accomplishments:

Methods. Use literature, past related research, and field observations to identify the abiotic and biotic factors that possibly could affect secondary succession. Two of these factors were studied in 1983: natural seedling emergence on various kinds of soil-surface microtopography, and seed production. Seedling emergence on different soil surfaces and microsites was evaluated on 13 sites representing eight range sites: Loamy 8-10", Claypan 10-12", Loamy 10-12", Loamy Slope 10-16", Claypan 12-16", South Slope 12-16", Loamy Slope 16+", and South Slope 14-18". The East and West Darling seedings were also studied. On each site, 29, 1 $ft.^2$ plots were established at 3.3 ft. intervals along a 100 ft. transect. Seedling density was determined by species, soil surface, and microsite on four, 0.25 $ft.^2$ subsamples at each sampling point. Soil surfaces and microsites present included coppice, coppice bench-trench, coppice bench-polygon, interspace-crack, interspace-polygon, and hoof depression. Data could not be analyzed statistically due to inadequate sample size for some microsites. Therefore, results should be used only to indicate the potential for each surface and microsite for seed germination and seedling emergence. In order to interpret this potential based on the amount of those surfaces actually present, the percent cover of each surface type on each range site was calculated from point data obtained in the frequency sampling procedure.

Seeds of native grasses were collected at 13 locations representing eight low to high elevation range sites: Loamy 8-10", Loamy 10-12", Claypan 10-12", Claypan 12-16", South Slope 12-14", Loamy Slope 16+", South Slope 14-18", and Riparian Aspen Woodland. Also, crested wheatgrass seed were collected on the West Darling Pasture. At each location, a sample consisted of three transects, each with five 21.5 $ft.^2$ plots per transect. Bulk seed from a large area were collected for those species that could not be sampled adequately on transects due to low plant density. Seeds were air-dried and hand-thrashed. For large samples, seeds were separated from chaff with a clipper mill. For small samples, seeds were hand separated. Quantity and quality characteristics will be evaluated by total seed weight, test weight/100 seeds, and germination. Only total seed weight is available for this report. These characteristics determined over time will define the variability in quantity and quality of seed in relation to climate, past grazing use (phenology and degree of use), range site, and range condition.

Results. We determined that the following factors can affect secondary succession: range site (potential productivity); quantity and quality of seed produced by desirable and undesirable species; seed size, seed dispersal and planting; seed depredation; soil seed bank; species requirements for germination, emergence, and establishment; and abundance and kinds of microsites that provide the physiological requirements of individual species for germination, emergence, and establishment.

Natural seedling emergence varied among soil surfaces and microsites on different range sites (Table 3.8). On the South Slope 14-18" Range Site, mountain brome grass had good seedling stands on both coppice and interspace-polygon surfaces, while the best stand of spike fescue occurred on the interspace-polygon surface. Good emergence on this soil may be due to a high organic matter content, a good moisture-holding capacity, and a non-crusting property, characteristics related to good emergence in other studies.

On lower elevation and drier sites, such as the South Slope 12-14" Range Site, sagebrush and bluebunch wheatgrass seedlings emerged better on the coppice surface. Sandberg bluegrass emerged equally well on coppice or on interspace-polygon surfaces. A similar response was found on the Loamy 10-14" Range Site with Idaho fescue and squirreltail seedlings mostly on coppice soil.

On the Loamy 8-10" Range Site, Sandberg bluegrass and squirreltail seedlings were more abundant on coppice and coppice bench-polygon surfaces. Seedlings in hoof depressions were first noted in abundance on this site. Since Loamy 8-10" sites are generally grazed early in the spring when soil is wet, hoof depressions are more probable here and on the Claypan 10-12" Range Site than on sites grazed later in the season.

The shallow argillic B horizon of the Claypan 10-12" Range Site maintains a wet surface soil later in the spring than that found on sites with a deeper argillic horizon. This wet surface over a relatively long period of time could contribute to the higher seedling density of Sandberg bluegrass and a relatively large number of early sagebrush seedlings on interspace soil. Grazing these wet soils could also lead to formation of hoof depressions that catch seed and provide a favorable microclimate for seed germination and seedling emergence.

Hoof depressions and the coppice surface provided favorable microsites for emergence of crested wheatgrass. Seedings are grazed very early in the spring when surface soils are often wet and susceptible to trampling. However, moderate trampling can form depressions that favor emergence of seed that falls into these microsites. Good emergence found on the interspace-polygon surface is probably a response to good seed production and seed rain on this surface in 1982, very favorable precipitation in 1982-83, and excellent seedling vigor of crested wheatgrass.

The relation between seedling emergence and soil-surface microsite may be confounded by range condition. First, past research has shown that as range condition declines the amount of generally unfavorable interspace soil increases and the amount of favorable coppice-type surfaces decreases. Therefore, although a seed source may be present, little favorable surface is available. Second, on high condition range, desirable plants occupy the interspace areas, thus seed rain occurs on the interspace soil surface and microsites. On low condition range, desirable species are restricted to the protection of shrubs and seed rain occurs there and not generally across all surfaces. Therefore, although a favorable surface may be present, no seed falls on that surface.

Table 3.8. Mean seedling density on various soil surfaces and microsites on different range sites in spring and summer, 1983.

Loamy Slope 10-16"

Species,[1] soil surface, and microsite	Density (no/ft^2)
Posa, coppice	6.0
Sihy, coppice	5.4
Feid, coppice	1.9
Sihy, coppice bench-polygon	1.1
Artrt, interspace-polygon	0.8
Sihy, interspace-polygon	0.8
Posa, interspace-polygon	0.6
Artrt, coppice	0.5
Agsp, coppice	0.4
Posa, hoof depression	0.4
Posa, coppice bench-polygon	0.4
Artrt, coppice bench-polygon	0.3
Agsp, coppice bench-polygon	0.3
Sihy, hoof depression	0.2
Artrt, hoof depression	0.1

Loamy 8-10"

Species, soil surface, and microsite	Density (no/ft^2)
Posa, coppice	13.4
Posa, coppice bench-polygon	8.1
Sihy, coppice	3.4
Sihy, coppice bench-polygon	2.7
Artrw, interspace-polygon	1.3
Sihy, hoof depression	1.1
Sihy, coppice bench-trench	0.9
Posa, hoof depression	0.8
Posa, interspace-polygon	0.6
Sihy, interspace-crack	0.4
Artrw, coppice bench-polygon	0.3
Posa, coppice bench-trench	0.2
Sihy, interspace-polygon	0.2
Artrw, coppice	0.1
Posa, interspace-crack	0.1

Claypan 10-12"

Species, soil surface, and microsite	Density (no/ft^2)
Posa, interspace-polygon	20.5
Posa, coppice	16.0
Arlo, interspace-polygon	4.4
Posa, hoof depression	2.2
Sihy, coppice	1.7
Arlo, coppice	1.7
Posa, coppice bench-polygon	1.2
Sihy, interspace-polygon	1.2
Posa, interspace-crack	0.6
Sihy, hoof depression	0.6
Arlo, hoof depression	0.4
Arlo, coppice bench-polygon	0.3
Arlo, interspace-crack	0.1

South Slope 14-18"

Brma, interspace-polygon	2.4
Heki, coppice	1.4
Brma, coppice	1.3
Mebu, interspace-polygon	1.1
Agsp, interspace-polygon	0.7
Mebu, coppice	0.7
Posa, interspace-polygon	0.6
Posa, coppice	0.6
Artrv, interspace-polygon	0.2
Sihy, interspace-polygon	0.1
Agsp, coppice	0.1
Heki, coppice	0.1

South Slope 12-14"

Agsp, coppice	6.7
Artrv, coppice	4.5
Posa, interspace-polygon	3.9
Posa, coppice	2.5
Agsp, interspace-polygon	2.1
Crac, interspace-polygon	0.8
Crac, coppice	0.6
Agsp, coppice bench-polygon	0.4
Artrv, coppice bench-polygon	0.2
Artrv, interspace-polygon	0.2
Posa, coppice bench-polygon	0.1
Posa, hoof depression	0.1
Sihy, coppice	0.1

East Darling Seeding

Agde, hoof depression	15.9
Agde, interspace-polygon	14.3
Agde, coppice	13.1
Agde, coppice bench-polygon	1.3
Agde, interspace-crack	0.9
Artrw, interspace-polygon	0.2
Artrw, coppice	0.1
Agde, coppice bench-trench	0.1

[1]See Appendix 1 for species symbols and scientific and common names.

Data in Table 3.9 show that interspace soil comprises most of the total soil surface on range sites studied. Therefore, since the physiological requirements for germination and emergence of Sandberg bluegrass and low and big sagebrush are met by both interspace and coppice soils, there is more surface area for potential recruitment of new individuals of less desirable and undesirable species. Conversely, more desirable species such as Idaho fescue and bluebunch wheatgrass, whose requirements for germination and emergence appear to be met better by coppice type soils, have less surface on which potential recruitment of new individuals can occur. Thus, in terms of revegetating the range sites studied, the least desirable species would seem to have an advantage. Exceptions to this speculation may occur at high elevations and on seedings where the interspace soil appears to be a favorable surface for emergence of seedlings of desirable species for reasons discussed previously.

Seed yield of grasses varied greatly among species and range sites (Table 3.10). A very high seed yield by crested wheatgrass at least partially explains the large number of seedlings of this species found on many soil surfaces and microsites on the Darling seeding. This kind of seed yield also explains why properly managed seedings can perpetuate themselves indefinitely.

Increaser species, such as Sandberg bluegrass and squirreltail, also had high seed yields, particularly on the drier loamy range sites and on Claypan Range Sites. Seed yield by the decreaser species, Thurber needlegrass, was very low. This difference in seed yield between increaser and decreaser species, together with a large proportion of soil surfaces that seem to favor emergence of increaser species, probably are reasons why range improvement through grazing management alone may be a very slow process on dry sites in low range condition. The higher elevation and more mesic range sites have a species composition that includes desirable grasses. Good seed production by bluebunch wheatgrass, Great Basin wildrye, mountain brome, Idaho fescue, slender wheatgrass, and Kentucky bluegrass results in seed rain by desirable species on soil surfaces that generally are favorable for seedling emergence of these species. Grazing management that allows for maintenance of vigor and seed production will ensure the recruitment of new individuals of desirable species, should an opening in the community occur. The actual number of viable seeds falling on each site will be determined from germination tests. We feel that the seed-cleaning procedures used have eliminated most of the empty or immature caryopses. Past experience has shown the germination of mature seed of most of these species has ranged from 50 to 90%. The exception is Great Basin wildrye, which has very low germination of seed collected from native stands.

Results of this study will be used to design experiments to test the effects of range site, season of emergence, grass species, type of soil surface and microsite, and levels of simulated precipitation on seedling emergence and establishment.

Table 3.9. Mean percent cover of coppice and interspace soil-surface types on selected range sites and a seeding.

Range Site or Seeding	Soil Surface Type	
	Cover (%)	
	Coppice[1]	Interspace
Loamy 8-10"	28	66
Loamy 10-12"	25	64
Claypan 10-12"	38	54
Claypan 12-16"	31	63
South Slope 12-14"	17	80
Loamy Slope 16+"	36	54
South Slope 14-18"	38	51
Seeding	28	66

[1]Includes both coppice and coppice bench surfaces.

Table 3.10. Mean seed yield by species on seven range sites and on a seeding in 1983.

Range site or seeding	Agde	Posa	Sihy	Stth	Agsp	Orhy	Elci	Brma	Feid	Stco	Mebu	Casp	Hoju	Agtry	Posc	Popr	Pone
	Species[1]																
	lb/ac																
West Darling seeding	23.3																
Loamy 8-10"		41.5	9.3	0.2													
Claypan 10-12"		34.2	6.4	0.3													
Loamy 10-12"		16.5	6.8														
South Slope 12-14" #1		23.4	6.9		3.3												
South Slope 12-14" #2					T[2]	0.1	0.8										
Claypan 12-16"		13.5			T												
Loamy Slope 16+"		0.1	0.2		1.4			2.2	3.3	0.1	T						
Riparian Aspen Woodland							0[3]	3.0		T		T	T	8.5	0.2	1.0	T

[1] See Appendix 2 for species symbols and scientific and common names.

[2] T = < 0.1 lb/ac.

[3] "0" indicates that individuals of a species occurred in the sample, but did not produce seed.

CHAPTER 4

SAGE GROUSE RESEARCH

Mack R. Barrington, and Gary N. Back

POPULATION DYNAMICS

1983 Objective:

Monitor sage grouse population parameters.

1983 Accomplishments:

Population dynamics were monitored with strutting ground counts and hunter harvest data. Strutting ground counts were conducted from 14 April through 25 May, 1983 using the Patterson census technique (Patterson 1952). Counts were conducted between sunrise and 0700 local time. Hunter harvest data were collected in a cooperative effort with Nevada Division of Wildlife (NDOW). A check station was operated 10-11 September, 1983 on the Mountain City Highway. Data collected included: number of hunters, number of hunter-days, number of birds bagged, and sex of birds bagged. A wing was collected from each bird for age and production information.

The estimated number of male sage grouse in 1983 was 121 (Table 4.1). The period of peak attendance occurred during the first two weeks in May. Female counts were consistently low, but peaked about the third week in April. Jenni and Hartzler (1978) found that the peak male attendance occurred 2-3 weeks after the peak hen attendance. Our observations revealed the same pattern (Table 4.1).

Based on a 40:60 male:female sex ratio (Beck 1977 and from NDOW), the estimated total population in 1983 was 303 sage grouse. This represents the first increase since 1979 (Table 4.2).

Only 14 hunters checked at the check station hunted on or near the Saval Project study area. They had bagged only 17 birds. Because this sample was so small, data collected by NDOW for Area 6 (which includes the Project area) were used to estimate age and sex ratios (Table 4.3). The sex ratios of yearling and juvenile age classes were not significantly different from the expected ratios of 40:60 and 50:50, respectively. However, the adult sex ratio deviated significantly from the expected ratio of 40:60 (χ^2 = 17.3, p<0.005). Whether the observed adult sex ratio was an indication of the population sex ratio or a result of differential harvest rates is not clear. However, hunters do concentrate on stringer meadows that are used by females with broods in late summer. Therefore, the potential for harvesting a disproportionate number of adult females exists. A larger sample from all of Region II (439 adults) had a similar ratio of 27:73 (NDOW, unpubl.).

The ratio of juveniles to breeding age females was 1.25:1 in 1983 com-

Table 4.1. Count and date of peak attendance at sage grouse strutting grounds, Saval Ranch, 1983.

	Strutting Ground										
Males	1	2	3	4	5	6	7	8	9	10	Total
Max. Count:	0	0	16	11	16	25	46	1	0	6	121
Date:			5/13	5/12	5/16	5/03	5/07	5/13		5/13	
Females											
Max. Count:	0	0	1	1	3	5	10	1	0	1	21
Date:			4/25	5/12	4/17	4/16	4/16	5/16		5/13	
No. Counts:	4	6	6	5	6	7	10	5	5	5	

Table 4.2. Sage grouse population estimates and date of peak male attendance at strutting grounds, 1979-1983.

	Year				
	1979	1980	1981	1982	1983
Males (counted):	269	181	157	107	121
Date:	--	4/18 -5/1	4/17 -5/1	4/28 -5/8	5/3- 5/20
Females (calculated):	404	272	203	161	182
Total:	673	453	393	268	303

Table 4.3. Sage grouse age and sex data from hunter check stations; Area 6 and Saval Ranch combined data, 1983.

	Adult	Yearling	Juvenile	Total
Male:	22	9	58	89
Female:	86	22	75	183
M:F ratio	20:80	29:71	44:56	33:67

Table 4.4. Estimates of female sage grouse success in raising broods, based on hunter check station data; Area 6 and Saval Ranch combined data, 1983.

	Successful	Unsuccessful	% Successful
Adult Females	40	46	46.5%
Yearling Females	5	17	22.7%
Total	45	63	41.7%

pared to 0.3:1 in 1982. The estimate of successful females was also greater in 1983 (42%, Table 4.4) than 1982 (25%). However, both indices indicate production was low in 1983. Upon examination of the production data for Area 6 in 1982, a population increase in 1983 was not expected. But the strutting ground counts did indicate a slight increase in population for the Saval Project area.

Bands from two males that had been banded near strutting grounds in May, 1983 were turned in at the check station. Both birds had left the study area; one was killed approximately 4 miles from the trap site and the other was killed 16 miles from the trap site. These returns were the first from the 36 birds banded since April, 1982. They suggest that population estimates from strutting ground counts may be for a population that inhabits an area larger than the study area boundaries.

HABITAT UTILIZATION

1983 Objectives:

1. Quantify vegetation characteristics of habitats used during summer.

2. Identify and quantify habitats used in winter and identify climatic factors that influence movements and/or habitat selection.

1983 Accomplishments:

Summer Habitat Use -

Radio telemetry was used to obtain 85 habitat use observations from four birds. Telemetry observations were made throughout the day, but primarily during early morning or late evening feeding periods.

The initial objective was to obtain data on habitat use by males, females with broods, and females without broods. Of the four birds successfully radio-collared, two were male and two were broodless females. One male moved north of the trap site to private lands adjacent to the project area 14 days after being banded and radio-collared. This male remained off the study area for the summer. The other male either made a major move off the study area (beyond telemetry range), was lost to predation, or the radio failed after two weeks. No further contact was made. One of the females also left the study area after one week while the other remained on the study area throughout the summer. Consequently, the majority of the observations were from the broodless female. Habitats used by the other three birds before leaving the study area were similar to those used by the resident female, so all observations have been combined for this report.

Observations were classified by activity (Table 4.5) and 88% of the observation sites were sampled. Vegetation parameters estimated included shrub cover, density, and composition as well as grass-forb cover and composition.

Habitats or cover types were classified by the dominant species system

Table 4.5. Classification of sage grouse telemetry observations by activity and time of day, Saval Ranch, 1983.

Sex of Bird	No. Obs.	No. Sites Sampled	Roosting Obs. Day	Roosting Obs. Night	Feeding Obs. A.M.	Feeding Obs. P.M.
Male	12	9	5	1	4	2
Female	73	66	19	7	33	14
Total	85	75	24	8	37	16

Table 4.6. Number of sage grouse observations by habitat for summer feeding and roosting, 1983.

	Habitat Type (based on dominant shrub(s))				
Activity	Alkali sagebrush	Alkali sagebrush with Wyoming big sagebrush islands	Alkali and Wyoming big sagebrush mix	Wyoming big sage brush	Meadow
Feeding	10	16	7	18	2
Roosting	3	18	6	4	1

(see Habitat Availability section). Habitats used are shown in Table 4.6. Feeding in meadows accounted for only 2.4% of the observations, as in 1982 when males and broodless females made little use of meadow types. Both 1982 and 1983 were above normal moisture years and upland sites may have provided sufficient forbs for sage grouse (see Vegetation; Production section).

Similar habitats were used for roosting and feeding (Table 4.6). Because these are not totally independent activities, the overlap in habitat use was not unexpected. Observations of some birds feeding while others roosted were common. This may account for the high use of alkali sagebrush types that have scattered "islands" of Wyoming big sagebrush. During summer days the roosting birds were found in the big sagebrush islands and the feeding birds were in the alkali sagebrush areas. The big sagebrush provided both shade and cover. Night roosts, under favorable weather conditions, were in open sites with less overhead cover. The alkali sagebrush type and the alkali sagebrush with islands of big sagebrush type provided this open condition. Roosts (day and night) in foul weather were in the big sagebrush cover types, but our sample size under these conditions was small.

A comparison of sites used primarily for roosting vs. feeding indicated significantly higher forb and grass coverage at feeding sites ($t = 3.6$, 61 d.f., $p<0.001$). The importance of forbs in the summer diet of sage grouse is well documented (Leach and Hensley 1954, Klebenow and Gray 1968, Pyrah 1969, Peterson 1970, Wallestad et al. 1975).

Within feeding sites, those dominated by Wyoming big sagebrush had a significantly greater amount of forb cover than the alkali sagebrush sites ($t = 2.4$, 34 d.f., $p< 0.05$). Use of alkali sagebrush sites can be explained in part by the time of day they were used. Sage grouse often night-roosted in alkali sagebrush habitats and started their early morning feeding in this habitat type. This type is found on Claypan 10-12" p.z. Range Sites, the only ecological site that had a significant increase in forb production over 1982 (see Vegetation chapter, Production section).

Information is needed on females with broods, as well as on habitat use by all sage grouse in dry years when forbs are less abundant, to complete the summer habitat use picture.

Winter Habitat Use

A winter habitat use and movement study was initiated in October, 1982. Radio telemetry and visual sightings were used to identify winter habitat use. The locations of all sightings were recorded as well as sex and age composition of the flock (as could be determined), number of birds observed, activity, time of day, habitat type, slope, aspect, and weather conditions. Measurements of shrub cover, density, and height above snow and snow depths were taken at a sample of locations for each habitat type.

In 1982-83, 45 observations were made between 28 October and 30 March. Although snow storms occurred as early as October, all sagebrush species were available until 26 January, 1983 when alkali sagebrush was covered

by snow. While alkali sagebrush was available, 65% of the sage grouse used cover types dominated by alkali sagebrush (i.e. alkali sagebrush or alkali sagebrush with islands of Wyoming big sagebrush cover types). Feeding, as evidenced by tracks and visual examination of shrubs, was primarily on alkali sagebrush (Fig. 4.1). The islands of Wyoming big

Fig. 4.1. Sagegrouse feeding in alkali sagebrush.

sagebrush in the alkali sagebrush type were used as roosting cover in winter, just as they were in summer. However, in winter grouse often roosted on the lee side of the sagebrush out of the wind or on the south or west side with maximum exposure to the sun. The remaining 35% of the birds were in cover types dominated by big sagebrush, with 17.5% of the observations made during snow storms or periods of high (>20 mph) winds.

Between 26 January and 2 February, 1983, a series of snow storms increased snow depths from 10 in to 20 in or more. During this period, sage grouse shifted their use from Middle Mahala and Upper Sheep Creek pastures to Lower Mahala and Lower Sheep Creek Pastures. A shift in habitat use also occurred. All observations from 26 January until 30 March were of birds in Wyoming big sagebrush types on south facing slopes, level benches, or on the lee side of ridges. Alkali sagebrush was available again at the end of March and sage grouse moved back to Middle Mahala and Upper Sheep Creek pastures, using the alkali sagebrush types.

The movement and habitat use pattern was similar in 1983-84 except that the shift occurred earlier in the season. Snow accumulations greater than 10 in occurred by mid to late November and birds began to use the Wyoming big sagebrush types. Alkali sagebrush was no longer available by early December. Sage grouse used the same areas in Lower Mahala and Lower Sheep Creek pastures as in 1982-83, but some grouse remained in the upper pastures. All male flocks observed in December and January were in the foothill region (elevations up to 6,600 ft). Some mixed sex flocks remained in Upper Sheep and Middle Mahala pastures.

We suspect the difference in movement pattern between the two winters was due to the period of time required for snow accumulations to become sufficient to cover alkali sagebrush. In 1982-83, a gradual snow build up occurred, with alkali sagebrush becoming unavailable first at higher elevations. The movement of grouse from Middle Mahala to Lower Mahala pasture was also gradual. In 1983-84, the series of storms in late November made alkali sagebrush unavailable in Middle and Lower Mahala pastures at the same time. Some birds remained in Middle Mahala and used big sagebrush habitats for a month before moving to Lower Mahala. Others made one long movement to big sagebrush habitats in Lower Mahala Pasture just after the snow storms covered up the alkali sagebrush. The male flocks that remained in the foothill region (South National Forest pasture) fed on mountain big sagebrush.

The apparent heavy use of alkali sagebrush cover types and the species itself, in both summer and winter, is not consistent with descriptions of sage grouse habitats from other studies. Eng and Schladweiler (1972) and Remington (1983) found Wyoming big sagebrush stands with greater than 20% canopy coverage were used more than stands with less than 20% canopy cover. Beck (1977) also found big sagebrush to be important winter cover. Summer habitat use studies (Peterson 1970, Wallestad 1971, Eng and Schladweiler 1972) refer to big sagebrush as the important cover shrub.

Food habit studies (Patterson 1952:198, Klebenow and Gray 1968, Martin 1970, Peterson 1970, Wallestad et al. 1975) have documented the importance of sagebrush in the sage grouse diet. In these studies, sagebrush comprised less than 80% of the food volume only during the summer months. However, the only mention of alkali sagebrush as a food item for sage grouse has been by Remington (1983) in Colorado, where it was a minor component used in proportion to its occurence.

Reports of sage grouse use of alkali sagebrush may not be common simply because alkali sagebrush is not as widespread as big sagebrush, each species occurring on 5,120 mi^2 and 226,400 mi^2, respectively (Blaisdell et al. 1982). Although the exact acreages of alkali and big sagebrush on the Saval area are not yet available, alkali sagebrush is relatively common at mid to low elevations (Upper, Middle, and Lower Mahala pastures and Upper and Lower Sheep Creek pastures). Based on our observations to date, we feel that the alkali sagebrush types are important cover types for sage grouse and that further investigation is warranted.

Specifically, we suspect that snow depth, because it affects the availability of alkali sagebrush, influences fall-winter and winter-spring move-

movements. Thus, in years with less than 10 inches of snow accumulation below 6,500 ft. elevation, sage grouse will remain in habitats used during late summer and fall. Movement to lower elevations and exclusive use of big sagebrush during January-March will not occur. In years of greater than 10-12 inches of snow accumulation, sage grouse will respond to changing availability of alkali sagebrush with eventual movement to lower elevations and a shift to use of big sagebrush.

We suspect that alkali sagebrush is preferred by sage grouse over big sagebrush and that this preference is due to differences in nutritional quality and/or content of secondary plant compounds (monoterpenoids). Many factors can influence nutritional quality and monoterpenoid content (Welch and McArthur 1979, Welch and McArthur 1981, Cedarleaf et al. 1983), including effects of grazing pressure and range alteration practices. Therefore, we propose to initiate comprehensive studies of: (1) sage grouse use of the several species/subspecies of sagebrush, (2) the impact of different grazing pressures on sagebrush nutrition and "palatability," (3) the impact of selected range alteration practices on nutrition and "palatability," and (4) the visual cues (if any) that sage grouse may use (or that managers can use) to identify plants with high nutritional vaues.

HABITAT AVAILABILITY

1983 Objective:

Complete the mapping of seral vegetation communities on BLM and private lands to determine the availability of habitats.

Background:

Vegetation mapping on the Saval has continued since 1980. Initial mapping work of Lower Sheep Creek and Upper Mahala pastures was done in 1980 by Natural Resource Consultants. They used the dominant plant method (Mueller-Dombois and Ellenberg 1974:35) to classify plant communities. We have continued to use this method to map additional areas of the ranch since 1980.

When classification of communities is considered, dominance is preferred over other species attributes (Ratliff and Pieper 1982). Also, species that are long-lived, self-perpetuating, conspicuous, persistent, and reflect the nature of the habitat should be used in the classification. In the Intermountain West, species such as sagebrush and perennial grasses provide a good basis for classification (Hironaka et al. 1983).

No classification system yet exists to group seral vegetation in the sagebrush ecosystem. For many years classifications have stressed potential vegetation as a basis to determine site potential. Two of the more accepted approaches have been the range site or ecological site described by Shiflet (1973) and the habitat type concept introduced by Daubenmire (1968).

Seral classification has only limited utility in providing a basis from

which to study trend at different sites. However, using potential vegetation in conjunction with current vegetation yields predictive power (Ratliff and Pieper 1982). Ratliff and Pieper (1982) also point out that sites with similar current vegetation may have different potentials and vice-versa. Anderson (1981) explained that when the classification system is used in hypothesis testing, there is a need to select basic data that are present and measurable as well as data on attributes which are indicative of change or are process sensitive. Our mapping effort has been guided by some of the points mentioned above. However, the major emphasis continues to be documentation of habitats available for sage grouse use and evaluating the effects of range improvements and grazing on those habitats.

The proportion and distribution type in each pasture is very important when comparing vegetative responses within and between treatment units. Stratified sampling within pastures is also facilitated by this system. Thus, it is our intent to produce maps which are also functional for other disciplines and workers concerned with vegetation distribution and changes.

<u>1983 Accomplishments</u>:

Ground truthing has been completed on all the BLM and private lands of the study area. Maps are at the scale of 1:7920. These trial maps will be used by researchers in 1984 and corrected if required. Final map products will be printed by winter 1984.

Thirty-seven different community types have been identified (Table 4.7): five types in the alkali sagebrush series, twenty-two types in the big sagebrush series, and ten miscellaneous types. Acreage estimates for each of these types have not been finalized.

Using the SCS soil survey information (Fig. 4.2), a tentative correlation has been attempted between current vegetation and potential vegetation (ecological sites) for the areas that have been mapped (Table 4.8). This represents the first attempt at relating vegetation information collected for sage grouse research with data gathered for range research. This effort needs to be refined before further applications can be made.

<u>Future Work</u>:

During 1984, mapping will be continued on National Forest lands. High quality aerial photography, requiring less ground truth, is now available for this area.

Upon completion of the mapping work, the mapped types should be characterized. Characterization will consist of samples to obtain composition, density and/or cover of trees, shrubs, grasses, and forbs. We hope to be able to use techniques similar to those used in the sage grouse habitat utilization research. Also, we intend to draw heavily from data on the monitoring plots established by range researchers on the project.

The final step will be to use established procedures for grouping mapped units, such as stand ordination or cluster analysis, to determine rela-

Table 4.7. Vegetation types mapped and identified through 1983.

Type Code[1/]	Type
	Alkali Sagebrush Series
1	Alkali sagebrush/Sandberg bluegrass.
2	Alkali sagebrush/Sandberg bluegrass with less than 20% Wyoming big sagebrush/low rabbitbrush/grass.
3	Alkali sagebrush/Sandberg bluegrass with 20-40% Wyoming big sagebrush/low rabbitbrush/grass.
4	Alkali sagebrush/Sandberg bluegrass with less than 20% mountain big sagebrush/antelope bitterbrush-Utah serviceberry/-grass.
5	Alkali sagebrush/Sandberg bluegrass with 20-40% mountain big sagebrush/antelope bitterbrush-Utah serviceberry/grass.
	Big Sagebrush Series
10	Wyoming big sagebrush/grass.
11	Wyoming big sagebrush/low rabbitbrush/grass.
12	Wyoming big sagebrush/low rabbitbrush/grass with less than 20% alkali sagebrush/Sandberg bluegrass.
13	Wyoming big sagebrush/low rabbitbrush/grass with 20-40% alkali sagebrush/Sandberg bluegrass.
14	Wyoming big sagebrush/low rabbitbrush/Great Basin wildrye.
15	Wyoming big sagebrush/low rabbitbrush-bluebunch wheatgrass.
16	Wyoming big sagebrush/low rabbitbrush/antelope bitterbrush/-grass.
20	Basin big sagebrush/grass.
21	Basin big sagebrush/low rabbitbrush/Great Basin wildrye.
25	Mountain big sagebrush/grass.
26	Mountain big sagebrush/low rabbitbrush/grass.
27	Mountain big sagebrush/low rabbitbrush-antelope bitterbrush-alkali sagebrush.
28	Mountain big sagebrush/rubber rabbitbrush/grass.
29	Mountain big sagebrush/antelope bitterbrush/alkali sagebrush/grass.

30 Mountain big sagebrush/antelope bitterbrush/low rabbitbrush (dense).

31 Mountain big sagebrush/antelope bitterbrush/low rabbitbrush/-Utah serviceberry (dense).

32 Mountain big sagebrush/antelope bitterbrush/low rabbitbrush/-Utah serviceberry (less dense).

33 Mountain big sagebrush/mountain snowberry/antelope bitter-brush/low rabbitbrush/Utah serviceberry/grass.

34 Mountain big sagebrush/common winterfat/alkali sagebrush/-grass.

35 Mountain big sagebrush/rubber rabbitbrush/alkali sagebrush/ antelope bitterbrush with 20-40% alkali sagebrush/Sandberg bluegrass.

36 Mountain big sagebrush/antelope bitterbrush/low rabbitbrush/-grass with 20-40% alkali sagebrush/Sandberg bluegrass.

37 Mountain big sagebrush/antelope bitterbrush/low rabbitbrush/-Utah serviceberry with less than 20% alkali sagebrush/Sand-berg bluegrass.

Others

45 Rubber rabbitbrush/grass.

46 Rubber rabbitbrush/basin big sagebrush/grass.

47 Dry meadow.

48 Wet meadow.

49 South slope-Wyoming big sagebrush/cheatgrass brome.

50 Low rabbitbrush/alkali sagebrush/Wyoming big sagebrush/Sand-berg bluegrass.

51 Low rabbitbrush/Wyoming big sagebrush/grass.

52 Gray horsebrush/low rabbitbrush/Wyoming big sagebrush/grass (bare ground).

53 Antelope bitterbrush/mountain big sagebrush/low rabbitbrush with less than 20% alkali sagebrush/Sandberg bluegrass.

54 Willow/wet meadow.

1/ Coding sequence broken between species series and between subspecies series for future addition of new vegetation types.

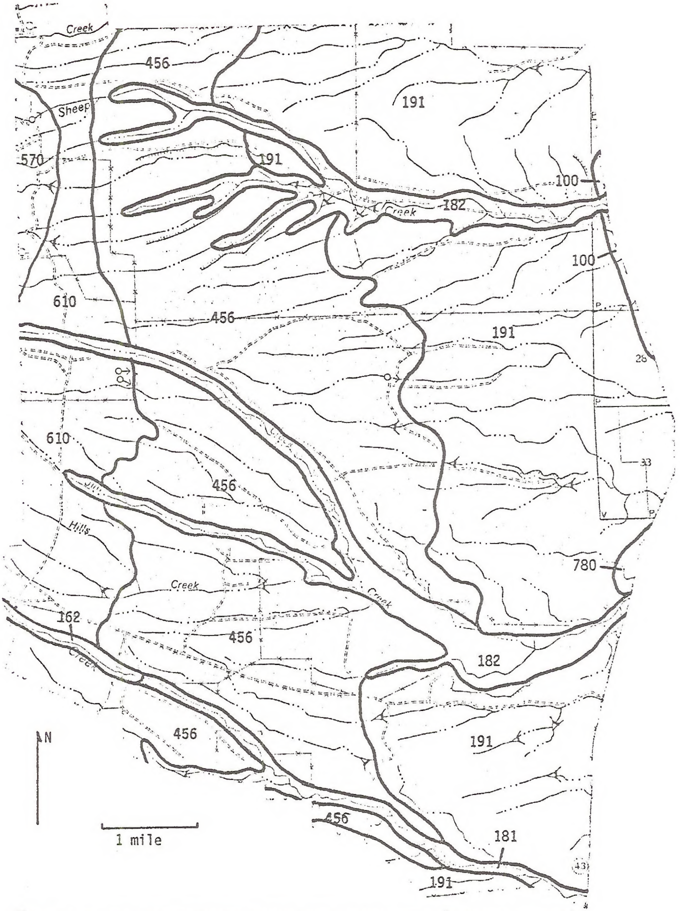

Figure 4.2. Soil associations of the Saval study area (BLM and private).

Table 4.8. Tentative correlation of mapped vegetation types and SCS ecological sites found in the mapped area.

Ecological Site[1]	Soil Association Number; (%)[2]	Vegetation Types[3]
Claypan 10-12" p.z.	191(20), 456(45), 780(20)	1, 2, 4
Claypan 12-16" p.z.	610(30)	4, 5, 36
Dry Floodplain 6-10" p.z.	144(2), 162(50), 182(5)	14, 20
Loamy 8-10" p.z.	144(98), 191(80), 456(22), 780(65)	10, 11, 12, 13, 15, 51, 50
Loamy 10-12" p.z.	456(30)	16, 25, 26, 27, 29, 30, 34, 35, 36, 37
Loamy Bottom 8-14" p.z.	182(75), 610(3)	20, 21, 45
Loamy Slope 12-16" p.z.	610(40)	28, 31, 32, 33, 53
Moist Floodplain 6-10" p.z.	162(5), 181(5)	20, 47
Saline Bottom 6-10" p.z.	181(15)	46
Sodic Flat 8-10" p.z.	162(2)	46
South Slope 6-10" p.z.	610(20)	49, 52
Upland Browse 12-16" p.z.	610(5)	33, 53
Wet Meadow 10-16" p.z.	162(41, 181(80, 182(20) 456(3), 610(2)	48

[1]From USDA/SCS Ecological Site Descriptions for the Owyhee High Plateau.

[2]Percent of each Soil Association which has been classified as the given Ecological Site (USDA-SCS 1983).

[3]Tentative correlation of our mapped vegetation types (current) with SCS Ecological Sites (potential vegetation).

tionships between mapped types. The feasibility of investigating the relationships of current vegetation with potential vegetation will also be studied.

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CHAPTER 5

MULE DEER

Donald A. Klebenow

Fig. 5.1. A mule deer fawn makes use of summer cover on the Saval Ranch. Photo by J. K. McAdoo.

Project 1: Species composition of tamed deer diets

Investigators: Debbie Selby and Donald A. Klebenow

1983 Objectives:

1. Determine the botanical composition of mule deer summer diets on the Forest Service allotment through the use of tame deer.

2. Provide data input to determine the extent of competition between mule deer and cattle.

1983 Accomplishments:

The second field season's data were collected during 1983. Three tame deer were observed throughout the summer to obtain species composition of deer diets. Prior to the grazing season for the cattle, two sample areas

were fenced to exclude cattle and contain deer. These served as ungrazed controls for comparison with deer food selection in the grazed pastures.

At this time, the report on this portion is not completed. Ms. Selby is completing the work and developing it into a M.S. thesis. The data analysis was completed March 17, 1984, with a rough draft expected on April 15 and the thesis completed by May 15, 1984. Copies of the completed thesis will be distributed to cooperators and a summary of results will appear in next year's report.

Project 2: The influence of cattle grazing on mule deer diets in aspen communities of northeastern Nevada.

Investigators: Tom Morrell, Donald A. Klebenow and Verle Bohman.

Project sponsor: Nevada Agricultural Experiment S ation.

<u>1983 Objectives</u>:

To develop a research plan to -

1. Evaluate the effect cattle grazing has on forage plant phenology in the aspen community and determine if this influences mule deer forage selection.

2. Evaluate the nutritional quality of forages selected by mule deer on grazed and non-grazed areas.

<u>1983 Accomplishments</u>:

Field observations made during the summer, 1983, indicated that the aspen communities on the Forest Service grazing allotments were the one plant community that received use by mule deer and cattle throughout the grazing season. This dual use may result in competition for the forage, security, and thermal cover that the aspen type provides. A study of the interactions between mule deer and cattle in the aspen types could provide land managers valuable information for properly managing summer ranges.

A study plan has been developed and field research will be initiated in May, 1984. Research plots will be fenced grazing studies. Two 2-acre plots will be constructed, each divided into 1-acre subplots. On each sample site, one acre will be grazed to simulate the grazing that occurs in the Forest Service pastures. The remaining acre will remain ungrazed.

Tame deer will be utilized to measure the effect of cattle grazing. Data will be gathered on species selection, phenology stage of selected forage and the nutritional quality of selected forage, on both the grazed and ungrazed plots.

Fistulated cattle will be used to apply the grazing treatments to the sample areas. These cattle will provide data on forage consumed by cattle analogous to that gathered from the tame deer.

CHAPTER 6

NONGAME WILDLIFE RESEARCH

J. Kent McAdoo and Donald A. Klebenow

GENERAL RESEARCH OBJECTIVES

The primary long-range objective of this research is to determine population responses of nongame wildlife to vegetation changes brought about by grazing management systems. An important short-range objective is to determine the effects of range improvement practices (i.e., brush control and mixed species rangeland seeding) on nongame wildlife.

RODENTS

1983 Objective:

To determine relative abundance and species composition of rodents in the following areas: (1) the new Lower Sheep Creek (LSC) mixed species seeding, (2) a control site in the Upper Sheep Creek (USC) Pasture, and (3) a site in the older Darling Seeding (a crested wheatgrass monoculture) for comparative purposes.

1983 Accomplishments:

Rodent populations were sampled with grids of live traps for four consecutive nights. When possible, square grids of 100 traps (with 50 ft between traps) were used. The traps were baited with rolled oats and checked twice daily (morning and evening). All animals caught were ear-tagged, sexed, weighed, and released. We used the number of rodents caught per 400 trap-nights as minimum estimates of relative abundance for each trapping period. We plan to analyze tag-recapture data with "Program Capture," a program which handles statistical inference procedures for capture data from closed animal populations (Otis et al. 1978).

Vegetation on rodent grids was sampled in order to determine differences in shrub canopy cover and herbaceous cover among the sites. We used a 4.4 yd line intercept to estimate shrub cover at alternate trap stations (218.8 yd total), and also measured individual shrub heights along each intercept. Frequency of herbaceous species was estimated using a step-point method, with step-points located at each station and mid-way between stations (190 step-points per sampling grid). We used a .12 yd^2 plot frame at 35 systematically located points to estimate herbaceous cover.

Thirteen rodent trapping grids were conducted during 1983. Approximately 1300 animals were caught during this sampling effort of 5200 trap-nights. Since emphasis this year was placed on the response of rodents to the plowing and seeding of the LSC Pasture, results from rodent sampling are discussed in Chapter 9 (Evaluation of the Lower Sheep Creek Seeding).

BIRDS

1983 Objective:

To determine relative abundance and species composition of bird populations in the following areas: (1) the new LSC mixed species seeding and an untreated sagebrush site in the USC Pasture, and (2) various riparian areas in the Forest Service pastures.

1983 Accomplishments:

Bird transects were conducted beginning at sunrise for three consecutive days (weather permitting), and consisted of 5-minute stops at five variable circular plots 0.3 mi apart. All territorial males seen and heard were recorded at each stop. For purposes of this report, bird abundance values have been reported as mean number of birds observed per transect-day. We plan to determine bird density (by species) with a method similar to that described by Szaro and Balda (1982).

We sampled vegetation systematically at three locations along each bird transect in the seeding and untreated sagebrush sites. Shrub cover was estimated with two 54.7 yd line intercepts at each sampling location. We also measured individual shrub heights along each intercept. Frequency of herbaceous species was estimated by sampling with 100 step-points at each location. We used a .12 yd^2 plot frame at every 10th step-point to estimate herbaceous cover.

The preliminary results of bird population sampling in the LSC seeding and USC control site are discussed in Chapter 9 (Evaluation of the Lower Sheep Creek Seeding).

We also began vegetation sampling this year along bird transects in riparian areas of the Forest Service pastures. Because of the mosaic vegetation types that occur along these drainages, we plan to eventually sample vegetation intensively at each station of the individual bird transects. For those transects were vegetation sampling was initiated this year, the methods discussed below were employed.

Since the riparian areas sampled were very narrow and differed in edge-effect of diverse adjacent vegetation, we sampled a minimum of three vegetation types at each bird count station along the bird transects: (1) actual riparian habitat (within approximately 55 yd of the stream channel), (2) north slope vegetation within 164 yd of the stream, and south slope vegetation within 164 yd of the stream. We also sampled aspen stands at stations where they were located within bird detection distance (approximately 164 yd).

Along each bird transect in the riparian, north slope, and south slope habitats, we placed a 109 yd vegetation transect parallel with the drainage at each bird counting station. Shrub canopy cover (by species) was estimated along 4.4 yd line intercepts at 10.9 yd intervals (43.8 yd total at each station). We also estimated average shrub height (by species) along each line intercept. On transects in the actual riparian

habitat, we took the following measurements for willows where they occurred: (1) percent canopy cover along each 4.4 yd line intercept, (2) height to nearest live limb (from the ground), (3) maximum height of live growth, and (4) maximum height of dead limbs.

Shrub cover and heights in aspen habitats (at each bird counting station where aspen stands occurred) were sampled as described for the other habitats. Aspen and chokecherry trees were sampled every 21.9 yds with a point-centered quarter method. In each quarter, we measured distance to the nearest live tree, tree diameter (dbh), height to nearest live limb, and total height. Snag densities were determined by counting all snags within a 21.9 yd radius. Total height and dbh for each of these snags was also measured.

Results of the 1983 bird transects conducted in riparian zones of the Forest Service pastures are listed in Table 6.1. Three of the four drainages sampled were in the South National Forest (SNF) Pasture which was ungrazed at the time of Sampling. The Stump Creek drainage in the North National Forest (NNF) Pasture, was sampled immediately after cattle were turned in to graze this pasture. The lower abundance recorded for some bird species and lower total abundance in this area was probably less affected by a few days of grazing than by the comparatively late sampling, bird counts obtained past the peak of the breeding season can be expected to be lower.

For the most part, results from bird population sampling in these areas this year were similar to those obtained for the same drainages in 1982. Of particular interest, mourning doves were recorded in disproportionately high numbers along Mahala Creek, compared to the other drainages, during both years of sampling. In fact, breeding birds of this species were not encountered during 1983 in any of the other areas (Table 6.1). During both years total bird abundance was highest in the Mahala Creek drainage, as was total number of species (species richness).

The remainder of this discussion involves combined data from 1982 and 1983 (for statistical purposes) for eight important bird species in a comparison of the Gance Creek and Mahala Creek drainages. Although collection of vegetation data is not complete, we have compiled some data from the actual riparian habitats of these two drainages. Differences in vegetation (especially canopy cover and structure) may at lease partially explain some of the observed differences in abundance of breeding birds.

Three bird species commonly associated with willow cover in riparian zones of the Saval Ranch were yellow warblers, fox sparrows, and song sparrows. Although there was no significant difference in yellow warbler abundance between Gance Creek and Mahala Creek, fox sparrow and song sparrows were both significantly more abundant ($p<0.05$) on Gance Creek (Table 6.2). Willow canopy cover on Gance Creek was significantly higher ($p<0.01$) at 58.6% than the 7.6% estimated for Mahala Creek (Table 6.3). A difference that was not detected on vegetation transects was the large, continuous stands of willow that occurred on Gance Creek compared with the scattered "clumps" on Mahala Creek.

Fox sparrows and song sparrows seem to prefer the greater canopy cover

Table 6.1. Relative abundance and species composition of birds in riparian zones of National Forest pastures at the Saval Ranch during summer, 1983.

	Location-Starting Date for Sampling							
	Gance Cr.-6/20		Mahala Cr.-6/24		Jim Cr.-6/28		Stump Cr.-7/1	
Species	$\bar{X}$[1]	(%)	$\bar{X}$	(%)	$\bar{X}$	(%)	$\bar{X}$	(%)
House wren	11.0	(8.1)	16.0	(9.7)	22.4	(18.8)	10.0	(10.0)
Common flicker	1.4	(1.0)	5.6	(3.4)	1.6	(1.3)	1.4	(1.4)
Warbling vireo	6.6	(4.9)	5.0	(3.0)	8.0	(6.7)	6.0	(6.0)
Yellow warbler	29.4	(21.7)	25.0	(15.1)	19.0	(15.9)	13.0	(13.0)
Fox sparrow	15.4	(11.4)	11.6	(7.0)	9.0	(7.6)	7.0	(7.0)
Song sparrow	16.0	(11.8)	6.6	(4.0)	0.4	(0.3)	1.0	(1.0)
Lazuli bunting	3.6	(2.7)	4.0	(2.4)	5.6	(4.7)	1.0	(1.0)
American robin	13.0	(9.6)	20.0	(12.1)	9.6	(8.1)	6.4	(6.4)
White-crowned/sparrow	1.4	(1.0)	5.4	(3.3)	11.0	(9.2)	3.0	(3.0)
Rufous-sided/towhee	1.4	(1.0)	7.4	(4.5)	1.4	(1.2)	5.6	(5.6)
Green-tailed/towhee	13.4	(9.9)	18.6	(11.2)	13.6	(11.4)	23.4	(23.4)
Brewer's sparrow	0.0	(0.0)	4.4	(2.7)	0.6	(0.5)	6.0	(6.0)
Mourning dove	0.0	(0.0	9.6	(5.8)	0.0	(0.0)	0.0	(0.0)
Other species	22.9	(16.9)	26.6	(16.0)	17.0	(14.3)	16.0	(16.0)
Total	135.5	(100)	165.8	(100)	119.2	(100)	99.8	(100)
No. of species	22		25		21		22	

[1]$\bar{X}$ = relative abundance expressed as mean number of birds observed per transect day

[2]% = species composition

Table 6.2. Relative abundance of birds in riparian zones of Gance Creek and Mahala Creek at the Saval Ranch, combined 1982-83 data.

SPECIES	Mean No. of Birds per Transect-Day: Gance Creek	Mahala Creek
Yellow warbler	26.2	21.3
Fox sparrow	15.2	6.8*
Song sparrow	12.7	4.3**
White-crowned sparrow	1.0	4.2**
Rufous-sided towhee	0.7	5.8***
Green-tailed towhee	12.3	18.2***
Brewer's sparrow	2.8	9.0*
Mourning dove	0.0	14.2**
All species (Total)[1]	132.3	158.3**

* Means in the same row are significantly different at $p < 0.05$.
** Means in the same row are significantly different at $p < 0.01$.
*** Means in the same row are significantly different at $p < 0.001$.
[1]Total = all species observed on transects, not just those listed in table.

Table 6.3. Percent canopy cover of willow and shrub vegetation (preliminary data) in riparian habitats along two drainages at the Saval Ranch, 1983.

Vegetation	Canopy Cover: Gance Creek	Mahala Creek
Willow	58.6**	7.6
Shrub[1]	9.6	39.2
Big sagebrush	0.1	10.2**

** Means in the same row are significantly different at $p < 0.01$.

[1]Shrub = all shrub species recorded on transects.

and/or large, continuous stands of willow. Both species build their nests either on the ground or uunder the woody canopy (Harrison 1979). Yellow warblers, on the other hand, typically nest in an upright fork or crotch of shrubs or trees (Harrison 1979). They obviously thrive under both closed-canopy and open-canopy situations.

Relative abundance of another group of species was associated primarily with the shrub structure of the riparian habitats sampled. White-crowned sparrows, rufous-sided towhees, and green-tailed towhees were all significantly more abundant (white-crowned sparrows at $p<0.01$, both towhee species at $p<0.001$) on Mahala Creek (Table 6.2). Total shrub cover (including such species as rose, currant snowberry, and big sagebrush) in the riparian habitats was also significantly higher ($p<0.01$) along Mahala Creek. All three of the bird species are recognized in the literature as being shrub-associated, nesting in shrubs or on the ground under them (Harrison 1979).

Brewer's sparrows could possibly be included with the shrub-dependent species discussed above. However, since this shrub-nesting species is considered a sagebrush obligate (Braun et al. 1976), we considered it separately. Brewer's sparrows were significantly more abundant ($p<0.05$) on Mahala Creek than on Gance Creek (Table 6.2). Not surprisingly, big sagebrush cover was also significantly greater ($p<0.001$) here, at 10.2%, vs 0.1% for Gance Creek (Table 6.3).

Mourning doves were significantly more abundant ($p<0.01$) along Mahala Creek (14.2 birds per transect-day) than along Gance Creek (0.0 birds per transect-day). The reasons for this vast difference are not clear. Mourning doves typically nest in trees, but will also nest in shrubs (Harrison 1979). We suspect that, possibly because of their ground foraging habits, they prefer the more open canopy situation that exists along Mahala Creek. Although we have not sampled herbaceous vegetation in the riparian zones, we also think there may be a greater abundance or availability of food, such as seeds of weedy forbs, along Mahala Creek. Since this species and others may be more influenced by herbaceous cover, we are currently developing methods for sampling this vegetation layer along the various drainages.

Another obvious difference in bird populations between Gance Creek and Mahala Creek (as discussed previously for 1983 data) was total bird abundance. Total abundance was significantly higher ($p<0.01$) on Mahala Creek. Although there are many possibly explanations for this, we believe the greater shrub component on Mahala Creek (39.2% shrub cover) and mosaic effect of "patchy" sparse canopy willow cover resulted in more "edge" than is available for birds along Gance Creek. Back (1982) reported that increased edge brings about an increase in total avian density. The greater number of species (species richness) along Mahala Creek could also be the result of this habitat difference. Both Lay (1938) and Back (1982) indicated that species richness was higher in areas with more edge.

Riparian zones support the greatest diversity and abundance of bird life on the study area. Therefore, any changes in vegetation resulting from the cattle grazing management system should eventually result in detect-

able changes in riparian bird populations. Riparian zones are also typically more affected by grazing than other habitats because cattle are attracted to the lush vegetation, water and shade provided by these areas.

Some of the current differences in bird populations between Mahala Creek and Gance Creek may be due to a lowering of the water table on Mahala Creek through channel cutting. This phenomenon may be responsible for the encroachment of sagebrush in this drainage and the higher abundance of Brewer's sparrows. Conversely, willow cover may have decreased in response to the lowering water table, resulting in lower populations of species such as fox sparrows and song sparrows, and possibly in the higher abundance of mourning doves. Whether or not the channel cutting on Mahala Creek is due to "natural" factors such as climatic and hydrologic events, cattle grazing, or some combination of these is not known. The steeper slopes in the Mahala Creek drainage, compared with Gance Creek, also serve to complicate any theories about the exact cause(s) of the channel cutting.

Not much information is available on riparian bird communities in the Great Basin (Kindschy 1978). With our comparison of bird populations and habitats in four drainages on the ranch, we hope to eventually obtain answers to the questions of how and why some bird species are related to various habitat components. With this knowledge we should be able to predict bird population responses to the riparian vegetation changes expected to result from the livestock grazing practices. Over time, we can then monitor actual bird responses and compare them with predicted responses.

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CHAPTER 7

FISHERIES RESEARCH

William S. Platts

General Research Objectives

The study goals for the 1983 fiscal year embodied continuation of the time trend analysis of fishery and riparian habitat conditions on Gance Creek. This is in agreement with the overall objectives of the fisheries phase of the Saval Ranch Project and the Livestock-Fishery Interaction studies, more fully described previously by Platts and Nelson (1983), which include the following:

1. Determine the rehabilitative potential of Gance Creek based on past, present, and future livestock grazing strategies;

2. Evaluate the usefulness of excluding livestock from the Gance Creek riparian zone by studying protected habitat within a fenced exclosure;

3. Evaluate the compatibility of the existing deferred grazing system with the fisheries habitat of Gance Creek; and

4. Make recommendations as to the optimum grazing strategies relative to use and protection of the riparian zone.

1983 Objectives

1. Collect data on geomorphic/aquatic, riparian, streamside herbage (not reported here), and fish population as in previous years;

2. Compare these FY 1983 data with that of previous years;

3. Discuss any habitat condition trends that may be becoming apparent as the data base increases;

4. Discuss any extraneous factors that may be influencing the fishery system;

5. Monitor stream temperature in cooperation with BLM personnel.

1983 Accomplishments

Approach

The study design of the fisheries phase of this study involves the stratification of 1,800 ft of Gance Creek into 181 equidistant stream cross sections, placed at 10-ft intervals along the right streambank (determined by facing upstream) and perpendicular to the main streamflow. This

stream section was subdivided into three smaller sections of 600 feet each, the central section (site 2) was fenced to exclude livestock, and the two external 600-ft sections (sites 2 and 3) continued under the existing grazing management of the allotment and served as control sites (see Fig. 6.1 in 1982 Progress Report). At each of the 181 transects, a variety of habitat variables was measured. These variables fell into four fundamental categories and include the following:

Geomorphic/Aquatic

1. Substrate surface materials;
2. Substrate particle embeddedness;
3. Water column width and depth;
4. instream vegetal cover;
5. Stream shore depth;
6. Pool width, quality, and feature of origin;
7. Riffle width;
8. Streambank angle and undercut;
9. Fisheries habitat quality;
10. Canopy coverage and light intensity; and
11. Water temperature.

Riparian

12. Streambank stability;
13. Overhanging vegetal cover;
14. Forage biomass and utilization; and
15. Streambank alteration.

Biological

16. Fish species composition, numbers, biomass, and condition.

Descriptions of the techniques employed can be found in Platts et al. (1983).

New Variables/Changes in Methodology

Several changes occurred in the data collection procedures at our Gance Creek site. Water temperature data collection was initiated using two continuous recording, underwater thermographs. Habitat type was not recorded, in anticipation of a more thorough soil and vegetation based riparian typing system to be conducted in 1984. Hydrologic data and channel profiles were not collected in 1983, but will be studied on an alternate year basis due to cutbacks in manpower and funds.

Results and Discussion

Geomorphic/Aquatic Analysis

Results from the 1983 geomorphic and aquatic analysis are presented in Table 7.1. The seventeen variables measured describe water column, streambank, and channel conditions within the grazed (control, sites one

Table 7.1.--Summary of geomorphic/aquatic results for 1983, Gance Creek, Nevada.

Variable	Site 1			Site 2			Site 3		
	Mean	S.D.	C.I.	Mean	S.D.	C.I.	Mean	S.D.	C.I.
Geomorphic/aquatic									
Water Column									
Stream width (feet)	6.5	1.7	6.0-6.9	6.4	1.8	5.9-6.8	6.7	2.3	6.1-7.2
Stream depth (feet)	0.30	0.15	0.26-0.33	0.29	0.09	0.27-0.31	0.27	0.16	0.23-0.31
Riffle width (percent)	36.8	33.7	28.1-45.4	38.8	31.4	30.7-46.9	43.5	33.1	34.9-52.1
Pool width (percent)	63.2	33.7	54.6-71.9	61.2	31.4	53.1-69.3	56.5	33.1	47.9-65.1
Pool rating	2.8	1.4	2.4-3.1	2.7	1.2	2.4-3.0	2.6	1.3	2.2-2.9
Pool feature	5.0	Ø	5.0-5.0	5.0	Ø	5.0-5.0	4.9	0.5	4.8-5.1
Canopy cover**	47.8	46.2	36.0-59.7	23.9	34.8	14.9-32.9	32.5	44.6	21.0-44.0
Streambanks									
Bank angle (degrees)	119.6	33.8	110.9-128.2	107.9	31.3	99.8-116.0	119.2	38.7	109.2-129.2
Bank undercut (feet)	.21	.42	.10-.32	.28	.38	.18-.38	.22	.41	.11-.32
Bank depth (feet)	.14	.20	.1-.20	.13	.14	.10-.17	.10	.20	.1-.15
Fisheries environment rating*	2.3	1.0	2.1-2.6	2.5	0.9	2.2-2.7	2.1	1.0	1.8-2.4
Streambottom									
Fines <0.03 in. (percent)	5.9	11.2	3.0-8.7	3.4	8.4	1.7-6.1	7.2	12.7	3.9-10.5
Fines >0.03 in. (percent)	4.2	7.8	2.2-6.2	3.0	7.9	0.9-5.0	4.7	10.9	1.9-7.5
Gravel (percent)**	67.4	20.0	62.2-72.5	56.9	25.6	50.3-63.5	68.6	27.5	61.5-75.7
Rubble (percent)	20.9	20.0	15.7-26.0	25.2	23.6	19.1-31.3	13.7	21.4	8.2-19.2
Boulder (percent)	1.7	6.4	0.1-3.3	11.0	16.3	6.8-15.2	5.8	12.8	2.5-9.1
Substrate embeddedness*	2.9	0.6	2.7-3.0	2.7	0.5	2.6-2.8	2.9	0.8	2.7-3.1
Instream vegetal cover (feet)	0.4	0.9	0.2-0.7	0.3	0.8	0.1-0.5	0.5	1.0	0.2-0.7
Riparian									
Habitat type[1/]									
Bank cover stability	2.4	0.6	2.2-2.5	2.2	0.8	2.0-2.4	1.9	0.6	1.8-2.1
Stream cover	2.0	0.7	1.8-2.1	1.8	0.6	1.6-1.9	1.8	0.7	1.7-2.0
Vegetation overhang (feet)	.18	.37	.08-.27	.18	.35	.09-.27	.10	.24	.03-.16
Vegetation use (percent)**	41.8	26.5	35.1-48.6	Ø	Ø	Ø	35.2	22.5	29.4-41.0
Bank alteration (percent)									
natural**	24.6	9.1	22.3-26.9	27.9	6.5	26.2-29.6	24.7	5.2	23.3-26.0
artificial	11.8	8.8	9.5-14.1	0.6	1.6	0.2-1.0	8.2	6.4	6.6-9.9
total	36.4			28.5			32.9		
Light intensity (percent)	71			57			62		

1/ Not measured in 1983.
* Significant difference between controls and treatment at P = .05.
**Significant at P = .01.

and three) and protected (treatment, site two) area. Table 7.2 summarizes results obtained for the six year period of study.

Water Column

Consecutive high water years, along with the usual climatic variability of this region and possible observer bias, make interpretations of water column trends extremely difficult. While the data indicate a slight improvement in the protected stream reach, these improvements are insignificant in light of the considerable fluctuation and off-site influences.

In 1983, water column attributes are very similar for all three sites, with the exception of canopy cover. This variable measures the number of degrees of arc in which the sun's rays are unobstructed in reaching the water's surface. The protected site had a significantly smaller cover canopy mean, denoting more shaded stream area than the other two sites.

Stream width and depth in 1983 were generally the highest recorded of the six year period, probably due to higher runoff and groundwater input from the previous wet winter. The upper control area (site 3) reversed its position in ranking from 1982, becoming the widest of the three sites. It is also the shallowest of the three reaches.

Pool and riffle percent have fluctuated dramatically over the past six years, largely as a result of observer bias. Observations in 1982 and 1983 were recorded by the same observer, however, and indicate that an increase in riffle in the control sites occurred in 1983. Riffle decreased slightly in site two. The overall trend since monitoring began appears to be a decline in the amount of riffle, with corresponding increase in the amount of pool habitat. We will continue to refine techniques that will hopefully reduce observer bias in the measurement of this variable.

Streambanks

Streambank measurements indicate an improved condition in the protected site in 1983. This area had a significantly smaller (better) bank angle than the two controls, along with a significantly better fisheries habitat rating. Undercut width was slightly better than the controls, but was not significant at the 5% level.

Overall, streambank variables have not fluctuated as much as our other habitat indicators during the past six years. Bank angles have improved slowly in sites two and three, while site one has slowly deteriorated. Fisheries rating has improved with the general increase in pool quantity and quality, however, further study is needed to determine if this recent rating increase in the treatment stream zone is a result of cattle exclusion.

Streambottom

Gravel continued to be the dominant substrate size class within the study area of Gance Creek, followed by rubble. Our 1983 results show a significant difference between grazed and ungrazed stream reaches for all sub-

Table 7.2.--Summary of annual geomorphic/aquatic results, Gance Creek, Nevada.

Variable	Study Site: Site 1 1978	1979	1980	1981	1982	1983	Site 2 1978	1979	1980	1981	1982	1983	Site 3 1978	1979	1980	1981	1982	1983
Geomorphic/Aquatic																		
Water column																		
Stream width (feet)	5.1	5.2	6.0	5.9	6.3	6.5	6.0	5.6	6.5	6.1	5.9	6.4	4.5	5.5	6.4	6.2	5.6	6.7
Stream depth (feet)	0.19	0.22	0.24	0.22	0.29	0.30	0.22	0.22	0.25	0.22	0.23	0.29	0.15	0.19	0.21	0.21	0.21	0.27
Riffle width (percent)	69.4	73.7	43.1	60.6	26.4	36.8	78.4	78.6	48.3	77.8	41.9	38.8	70.6	75.3	53.1	74.1	36.2	43.5
Pool width (percent)	30.6	26.3	56.9	38.8	73.6	63.2	21.6	21.4	51.7	22.0	56.1	61.2	29.4	24.7	46.9	25.9	63.8	56.5
Pool feature[2/]	1.2	1.0	1.0	4.2	3.8	5.0	1.0	1.0	1.0	3.4	4.6	5.0	1.0	1.0	1.0	3.5	4.3	4.9
Pool rating	1.9	1.6	2.5	1.9	3.0	2.8	1.9	1.8	2.5	1.3	2.3	2.7	1.6	1.8	2.2	1.5	2.8	2.6
Canopy cover (degrees)	N.O.[1/]	N.O.	N.O.	56	40	48	N.O.	N.D.	N.O.	48	26	24	N.O.	N.O.	N.O.	55	38	33
Streambanks																		
Bank angle (degrees)	126	107	114	111	117	120	123	95	121	127	118	108	141	114	126	135	122	119
Bank undercut (feet)	0.06	0.20	0.17	0.22	0.19	0.21	0.09	0.33	0.18	0.16	0.23	0.28	0.08	0.14	0.14	0.10	0.13	0.22
Bank depth (feet)	0.05	0.10	0.12	0.08	0.10	0.14	0.04	0.07	0.10	0.05	0.07	0.13	0.03	0.04	0.10	0.05	0.06	0.10
Fisheries rating	1.1	1.4	1.8	1.6	2.1	2.3	1.1	1.6	1.7	1.6	1.7	2.5	1.5	1.4	1.7	1.5	1.8	2.1
Streambottom																		
Fines <0.03 in. (percent)	10.5	11.4	15.9	10.6	6.2	5.9	8.6	4.5	9.3	5.6	2.2	3.9	1.2	4.7	14.8	9.6	7.1	7.2
Fines >0.03 in. (percent)	8.1	4.8	1.7	2.8	5.8	4.2	1.7	2.5	2.2	1.0	3.7	3.0	7.9	6.5	3.7	5.8	8.6	4.7
Gravel (percent)	76.5	67.5	70.7	74.0	72.5	67.4	80.3	63.6	66.6	72.0	67.4	56.9	86.2	78.3	74.8	80.5	79.0	68.6
Rubble (percent)	3.6	13.1	9.4	10.8	13.4	20.9	8.3	22.5	14.3	14.1	18.2	25.2	3.0	6.3	3.1	1.8	1.7	13.7
Boulder (percent)	1.3	3.2	2.3	1.7	2.1	1.7	1.1	7.3	7.7	7.3	8.5	11.0	1.7	4.3	3.6	2.1	3.6	5.8
Substrate embeddedness	3.1	3.5	2.1	3.4	2.4	2.9	3.6	4.0	2.7	4.1	3.1	2.7	3.8	4.2	3.1	3.9	2.7	2.9
Instream vegetation cover (feet)	0.3	0.3	0.2	0.0	0.6	0.4	0.1	0.3	0.3	0.0	0.2	0.3	0.3	0.6	0.3	0.0	0.4	0.5

1/ N.O. - no data.

2/ The evaluation scale for this parameter was modified to include more ratings in 1981.

strate sizes. Trends in particle size distribution are leading to increased amounts of boulder and rubble with slight decreases in gravel and fine sediments, possibly due to the abnormally high water input and heavy scouring in recent years.

Substrate condition, as measured by particle size distribution, is generally better in the protected site. One exception to this is particle embeddedness, which fell in quality from 1982 levels.

Instream vegetative cover is slightly lower within the ungrazed reach compared to the controls, however, this area was the only site to show an actual increase over 1982 levels. Lower incoming solar radiation may be limiting the amount of immediate streamside vegetation in site two.

Riparian Condition

Our riparian variables are the most subjective in our battery of techniques and must, therefore, be interpreted with caution (Table 7.3). Observer bias is higher with these measurements, but within year comparisons between sites should be reliable. The habitat type variable was not collected in 1983, and will soon be replaced with a new riparian typing system. This system is currently being tested on our Idaho study areas and will incorporate soil and vegetative characteristics.

Bank cover stability is a categorical breakdown of the amount of stability-creating factors found on the streambank. Mean stability readings declined overall, with the treatment site dropping slightly more than the control sites (falling between the readings recorded in the upper and lower grazed areas). Since our alteration readings take into account past damage, bank stability ratings do not necessarily correlate with alteration readings. For example, site one, with the best stability ratings had the highest overall streambank alteration. Site three, with the lowest stability rating, had the next highest amount of alteration.

The subjective nature of measuring alteration makes this the most difficult variable to assess. In 1983, significant differences occurred in both natural and artificial categories. The protected area exhibited higher natural levels of disturbance, and much lower artificial levels than both grazed areas. The lower amounts of natural alteration in grazed areas can be attributed to a certain amount of "masking by vegetation" that occurs in grazed locations. Some natural alteration may be attributed incorrectly as artificial and vice versa.

Vegetation use estimates along our transect sample sites was lower than previous years, and was considerably lower than adjacent riparian meadow use estimates of 70-75% (R. Eckert, Jr., pers. comm.)

The 1983 light intensity readings show some deviation from 1982 findings. This was the second year this variable was measured and refinements are still being made in the techniques. The readings did correlate with results from canopy cover, and support the conclusion that the protected area has a much greater amount of shade cover.

Table 7.3.--Summary of annual riparian analysis results, Gance Creek, Nevada

	Study Site																	
	Site 1						Site 2						Site 3					
Variable	1978	1979	1980	1981	1982	1983	1978	1979	1980	1981	1982	1983	1978	1979	1980	1981	1982	1983
Habitat type	6.8	12.1	10.4	12.4	15.2	N.D.[1]	6.1	7.9	10.1	12.1	15.4	N.D.	12.0	8.5	10.6	10.8	13.5	N.D.
Bank cover stability	1.3	1.9	2.2	2.1	2.5	2.4	1.4	1.6	2.3	2.1	2.9	2.2	2.2	1.6	2.2	2.0	2.5	1.9
Stream cover	2.7	3.0	1.9	2.4	2.7	2.0	2.4	2.5	1.9	1.9	2.5	1.8	2.7	2.5	1.8	1.9	2.4	1.8
Bank alteration (percent)																		
natural	29	27	32	27	33	25	30	32	36	30	24	28	31	29	33	25	27	25
artificial	21	14	16	17	13	12	15	9	0	11	7	1	19	13	12	15	16	8
total	50	41	48	44	46	37	45	41	36	41	31	29	50	42	45	40	43	33
Vegetative overhang (feet)	0.09	0.18	0.07	0.15	0.33	0.18	0.14	0.12	0.14	0.13	0.37	0.18	0.06	0.08	0.14	0.06	0.28	0.97
Vegetation use (percent)	68	73	46	75[2]	55	42	53	15	>0	>55[1]	1	0	59	48	42	75	56	35
Light intensity (percent)	N.D.[2]	N.D.	N.D.	N.D.	61	71	N.D.	N.D.	N.D.	N.D.	60	56	N.D.	N.D.	N.D.	N.D.	59	62

[2] N.D. - no data.
[1] Data provided by Dr. Richard E. Eckert, Jr., Range Scientist, USDA-Agricultural Research Service, Renewable Resources Center, Reno, Nevada.

Temperature

Water temperature monitoring was initiated in the autumn of 1982. During the successive winter and spring runoff, one recorder was lost and the other unit malfunctioned. New temperature recorders have been installed and should yield data for next year.

Fish Population

The cutthroat trout population of Gance Creek continues to show large fluctuations in population parameters (Table 7.4). In 1983, numbers continued to decline in sites one and two, while the upper grazed area showed an increase (60%) over 1982 levels. Indeed, trout in site three showed improvements in all parameters measured in 1983--abundance (+60%), average weight (+22%), density (+21%), biomass (+37%), and average length (+6%). The lower grazed area, however, decreased in all categories.

The most drastic change, however, occurred in the ungrazed stream reach. The 1983 analysis shows an apparent shift to fewer and larger trout than grazed areas. Average weight increased by 62%, while numbers and density declined 40% respectively, within the protected areas. Fish condition declined slightly in all sites.

Sculpin numbers also declined in the two lower sites, but two specimens were collected in site three, where they had been absent since 1979.

Summary and Conclusions

All of our analyses demonstrate that extreme variability of the Gance Creek ecosystem. Streamflow, stream widths and stream depths have fluctuated from year to year in a manner that is probably related to annual precipitation patterns. Other physical variables responded in less direct ways, but the overriding consideration is, nevertheless, one of continual change.

Fish populations and community structure also fluctuate, but the driving mechanism may not be strictly determined by easily measured habitat variables in any clear-cut fashion. Part of the reason for this is that less is really known about the race of cutthroat trout inhabiting Gance Creek than we would like; efforts to discover the importance of various habitat variables is just beginning. At this point, it appears that there may be a somewhat cyclic pattern to trout population dynamics, with changes in abundance between 2 consecutive years of as much as 50% or more being common. Obviously, the status of the cutthroat trout population cannot adequately be estimated by a single census of the population; if any single determination of the status of the population in our study area were made in 1978, for example, the conclusion would have been far different from a similar determination made only 2 years later in 1980 when there were approximately 5.5 times as many trout in the study area.

While fish populations continue to fluctuate in a largely unpredictable manner, 1983 results show a slight overall improvement in the livestock exclosure stream section relative to the grazed areas. It must be remem-

Table 7.4.--Summary of annual fish population results, Gance Creek, Nevada

	Study Site																	
	Site 1						Site 2						Site 3					
Variable	1978	1979	1980	1981	1982	1983	1978	1979	1980	1981	1982	1983	1978	1979	1980	1981	1982	1983
Cutthroat Trout																		
Total catch (#)	32	175	303	203	183	156	64	184	294	288	170	102	110	216	472	524	126	201
Population estimate (#)	32	181	327	207	191	166	64	203	303	299	185	104	111	235	506	533	143	206
Mean length (in)	4.47	2.42	2.66	3.39	2.87	2.86	3.57	2.19	2.82	2.73	2.72	3.14	2.46	1.98	2.09	2.56	2.62	2.77
Mean weight (oz)	0.97	0.39	0.41	0.40	0.31	0.27	0.73	0.31	0.52	0.23	0.24	0.39	0.22	0.11	0.26	0.17	0.18	0.22
Estimated biomass (oz/ft^2[x10^{-2}])	1.0	2.3	3.8	2.4	1.6	1.1	1.3	1.9	4.0	1.9	1.2	1.1	0.9	0.8	3.4	2.5	0.8	1.1
Estimated standing crop																		
(#/ft^2[x10^{-2}])	1.0	5.8	9.1	5.8	5.0	4.3	1.8	6.0	7.8	8.2	5.2	2.7	4.1	7.1	13.2	14.3	4.3	5.2
(#/mile)	282	1593	2878	1822	1681	1461	563	1786	2666	2631	1628	915	977	2068	4453	4690	1258	1813
Population condition factor[1/]	1.0	0.8	0.9	1.0	1.4	1.3	1.0	0.8	0.9	0.9	1.4	1.1	1.0	0.7	0.9	0.9	1.4	1.0
Sculpin[2/]																		
Total catch (#)	203	17	53	37	94	43	1	2	5	27	29	8	0	1	0	0	0	2
Population estimate (#)	203	29	54	38	115	47	N.A.[3/]	N.A.	5	27	47	9	--	N.A.	--	--	--	2
Mean weight (oz)	0.05	0.20	N.D.[4/]	0.20	0.16	0.23	0.49	0.17	N.D.	0.17	0.23	0.26	--	0.27	--	--	--	0.39
Observed biomass (oz/ft^2[x10^{-2}])	0.3	0.1	N.D.	0.2	0.4	0.3	0.0	0.0	N.D.	0.1	0.2	0.05	--	0.0	--	--	--	0.02
Observed standing crop																		
(#/ft^2[x10^{-2}])	6.6	0.5	1.4	1.2	2.5	1.2	0.0	0.1	0.1	0.7	1.3	0.2	--	0.0	--	--	--	0.1
(#/mile)	1786	255	475	334	827	378.4	9	18	44	238	255	70	--	9	--	--	--	18
Sucker[2/]																		
Total catch (#)	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Population estimate (#)	--	--	--	--	--	--	--	4	--	--	--	--	--	--	--	--	--	--
Mean weight (oz)	--	--	--	--	--	--	--	0.17	--	--	--	--	--	--	--	--	--	--
Observed biomass (oz/ft^2[x10^{-2}])	--	--	--	--	--	--	--	0.0	--	--	--	--	--	--	--	--	--	--
Observed standing crop																		
(#/ft^2[x10^{-2}])	--	--	--	--	--	--	--	0.1	--	--	--	--	--	--	--	--	--	--
(#/mile)	--	--	--	--	--	--	--	35	--	--	--	--	--	--	--	--	--	--

[1/] This variable had to be estimated for 1980 by pooling data for all years and is probably over estimated.

[2/] Total catch figures used for biomass and standing crop determinations because non-game species frequently are not collected strictly in accordance with population estimation assemptions; population estimates are presented for consideration but should not be considered reliable.

[3/] N.A. - not available; capture pattern did not fit model closely enough to obtain even a poor estimate and/or total catch was zero.

[4/] N.D. - no data; non-game species were not weighted in 1980.

bered though, that we have had only two consecutive years of no grazing in the treatment area. More time is needed to determine Gance Creek's response to non-grazed conditions. Therefore, it is imperative that the treatment area be protected.

The improvements are, for the most part, minute. The overall improvement may follow in much the same pattern that we suspect initial damage was accomplished; by small "microchanges" in environmental conditions, resulting in an accumulative impact. It may take an extended period of protection for benefits to the fish fauna to be realized, if they are realized at all, considering the natural geoclimatic variability and considerable offsite watershed disturbances.

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CHAPTER 8

LIVESTOCK RESEARCH

Lynn Winer Woodell and Charles F. Speth

An Evaluation of Cattle Production Factors

1983 Objective:

Evaluate some economically important animal production factors on the Saval Ranch.

1983 Accomplishments:

The goal of a cow-calf ranch operation is to maximize the yearly pounds of beef weaned. Reproductive performance of the cow and rate of gain of the calf are two factors important in attaining this goal.

The 1983 reproductive performance of the Saval cow herd was monitored by percent conception, length of calving season, and percent calf crop weaned. A pregnancy test, by rectal palpation, was performed on each cow and percent conception was determined:

$$\text{Percent conception} = \frac{\text{pregnant cows}}{\text{total cows exposed}} \times 100$$

The 1983 conception rate was 88%. This was a 20% increase from the 1982 conception rate.

Length of calving season is an economically important animal production factor. An extended calving season, resulting in light weaning weights or animals too young to wean, is costly to the ranch owner through loss of sales and added labor. Therefore, we began monitoring the calving season of the Saval cow herd in 1983. The number of calves produced from mature cows, excluding calves from first-calf heifers, was counted on May 3, June 30, and December 27. The Saval cow herd produced 84 and 94% of their calf crop within 64 and 122 days of the calving season, respectively. The remaining 6% of the calf crop was born between July 1 and November 30, 1983. The exact birth date of the last calf born is unknown.

Percent calf crop weaned is perhaps the most important indication of herd production. It not only indicates reproductive performance but also calving and mothering ability of the cow. Calf crop weaned is based on the number of calves weaned as a percentage of total cows exposed to bulls. Using this definition the Saval cow herd produced an 81% weaned calf crop for 1983. This was a 22% increase from the 1982 weaned calf crop. This increase, along with the 20% increase in conception rate, indicates an improvement in herd performance possibly due to the sale of low producing animals and the initiation of infectious disease treatment in 1982. Twenty-five calves were considered too young to wean in 1983 as compared to 294 calves in 1982. One probable explanation for the smaller

number of unweanable calves in 1983 was the sale of 284 late calving cows in 1983. The 1983 percent calf crop, including the unweanable calves, was 83%. The 1983 weaning dates were several weeks later than 1982. This could also explain the higher 1983 percent calf crop and weaned calf crop values.

The number of calves at weaning along with their weight and market price will ultimately determine the success of a cow-calf ranch operation. Typically, calves are weaned and weighed the same day or succession of days regardless of their age. To remove this effect, weaning weights are adjusted to standard age, most commonly 205 days. In order to do this, birth date and weight for a sample of calves, and weaning weight must be known.

During March 1983, 35 female and 35 male calves were eartagged, weighed, and birth dates recorded. Respective birth weights for the two groups were 70 and 71 pounds (Table 8.1). There was no significant difference in birth weight between sexes or years (1982 vs. 1983).

Calves were again weighed at weaning (November 30 - December 27). The respective mean weaning weights for sampled heifer (N = 31) and steer (N = 29) calves were 410 and 423 pounds. The mean weight for the entire Saval Ranch weaned calf crop was 413 pounds.

The procedure for determining weaning weights adjusted to a standard 205 days was:

Computed 205-day weight = Average daily gain x 205 + birth weight where

$$\text{Average daily gain} = \frac{\text{Actual weaning weight - Birth weight}}{\text{Age of calf in days}}$$

Average daily gain for 1983 heifer calves was 1.28 pounds and 1.32 pounds for steer calves. Mean computed 205-day weights for heifer and steer calves was 333 and 343 pounds, respectively.

No valid statistical tests could be conducted between the 1982 and 1983 actual weaning weights, average daily gain, or 205-day computed weaning weights due to the 7-11 weeks difference in weighing dates between years. The 1982 calves were weaned October 13-15 while the 1983 calves were weaned November 30-December 27. The later weighing dates for the 1983 calves could explain their lower weights. As nutritional quality of the diet decreases and temperatures become colder in the fall months, rate of gain decreases and a weight loss can occur. Assuming this occurred in 1983, the lower rate of gain and older age of the 1983 calves (due to their later weaning) could diminish their overall average daily gain value, resulting in an erroneous 205-day computed weaning weight. In other words, the actual weight of the 1983 calves at 205 days of age could have been greater than the computed value. Had these calves been weighed earlier in the year, their average daily gain could have been greater and consequently their 205-day computed weight would have been greater.

If between year statistical tests are desired, an attempt must be made to generate more uniform weighing dates year to year. If, as seen in 1983,

Table 8.1. Calf production factors on the Saval Ranch for 1982 and 1982.

		1982		1983	
Production Factor	Sex	N[1]	$\overline{X}$[2]	N	$\overline{X}$
Birth weight (lbs)	Female	27	69	35	70
	Male	34	70	35	71
	Combined	61	70	70	70
Actual weaning weight (lbs)	Female	24	423	31	410
	Male	28	433	29	423
	Combined	52	428	60	416
Average daily gain (lbs)	Female	24	1.66	31	1.28
	Male	28	1.70	29	1.32
	Combined	52	1.68	60	1.30
205-day computed weaning weight (lbs)	Female	24	409	31	333
	Male	28	420	29	343
	Combined	52	415	60	338

[1] N = number of calves.

[2] $\overline{X}$ = mean value

later weaning dates are planned for future years, it is suggested that computed weaning weights be changed from 205 days to an age closer to the average age of the sampled calves at weaning. For example, the age of the sampled 1983 calves at weaning ranged from 249-287 days with a mean age of 266 days. Adjusting weights to 205 days of age increases the chance of error. A 265-day computed weaning weight would be more meaningful and provide less chance for error if later weaning dates are planned in future years.

The Saval cow herd (721 cows) and 287 weaned heifer calves were eartagged during the 1983 fall processing. If the birth year of the animal was known, the first digit of their four digit assigned number coincided with the last digit of their birth year. For example, the cows born in 1981 were assigned consecutive numbers from 1001 to 1132. If the birth year of the cow was unknown, she was assigned a number from 1 to 589.

Range Cattle Diet and Intake

1983 Objective:

Determine species composition, diet quality, and amount of forage consumed by range cattle using rumen-fistulated and four intact research cattle.

1983 Accomplishments:

Forage samples collected from four rumen-fistulated cattle and four intact cattle were analyzed to determine species composition, diet quality, and amount of forage consumed by range cattle. The pastures sampled during the 1983 season included:

Pasture	Before use[1]	After use[1]
1) West Darling	(4/19-29)	-
2) Upper Mahala Creek	(5/10-20)	(7/5-15)
3) South National Forest	(6/14-24)	(8/22-9/2)
4) North National Forest	(8/2-12)	(10/17-27)
5) Lower Sheep Creek	(9/20-30)	-

The West Darling (WD) pasture before-cattle-use sampling period scheduled for April 4-14 was cancelled due to snow cover. The Saval cow herd was scheduled to be turned onto this pasture April 16, 1983. Snow cover on the WD pasture prevented this turnout. The East Darling (ED) pasture was then substituted for main herd use because it had less snow cover. there was enough forage available on the WD pasture to provide adequate sampling by the eight research cattle. Therefore, rather than miss the crested wheatgrass sampling period, the research cattle were allowed to

[1] These sampling periods are explained in the Species Composition section of this report.

sample the WD pasture while the main cow herd grazed the ED pasture.

The later sampling of the West Darling pasture prohibited sampling on the Middle Mahala Creek pasture before cattle use. Sampling the Lower Sheep Creek pasture after cattle use in late fall was also terminated due to snow depth.

The same rumen and fecal sample collection procedures were used as reported in the Species Composition and Diet Quality sections of this chapter. Chemical and botanical analysis of 1983 rumen and fecal samples were not completed in time for this report. These results will be reported in the 1984 livestock research report.

Species Composition of Range Cattle Diets

1982 Objectives:

Determine the species composition of range cattle diets using forage samples collected from rumen-fistulated cattle.

1982 Accomplishments:

Samples collected from four rumen-fistulated cattle were botanically analyzed to determine the species composition of range cattle diets. The pastures sampled during the 1982 grazing season included:

Pasture	Before Use	After Use
1) Lower and Middle Mahala	(4/13-23)	-
2) Control Seeding	(5/4-14)	-
3) Control Native	(5/18-28)	-
4) South National Forest	(6/2-12)	(8/17-27)
5) North National Forest	(7/19-29)	(10/4-14)
6) East Darling	(10/19-29)	-

An attempt was made to sample the WD crested wheatgrass pasture March 29, 1982. Following 5 days of continuous snow, the snow depth prohibited proper grazing by the fistulated cattle and the sampling period was terminated. The control crested (CC) wheatgrass pasture was later sampled in place of the WD pasture.

The delayed sampling of the CC pasture caused a further change in the sampling schedule. The main cow herd was scheduled to be turned onto the Upper Sheep Creek (USC) and Upper Mahala Creek (UMC) pastures before these pastures could be sampled by the fistulated cattle. Rather than miss the sampling period, the Control Native (CN) pasture was sampled. The CN pasture had been part of the Upper Mahala pasture until fence construction the previous fall. The "after cattle use" sampling period on the ED pasture, scheduled for November 29-December 9, was also terminated due to snow.

The fistulated cattle grazed each pasture for 11 days before the main cow

herd entered the pasture. The National Forest pastures were also sampled again for 11 days after the main herd had been removed.

The fistulated cattle were allowed to graze approximately 6 hours each day and were kept in a corral at night. Rumen forage samples were collected during 3 days of each 11-day period using the following procedure:

1) rumen and reticulum contents were removed and saved in a container.
2) cattle were allowed to graze 30-45 minutes,
3) new rumen ingesta were collected, and
4) original rumen and reticulum contents were replaced.

A sub-sample was removed from each rumen sample. These sub-samples were oven-dried and sent to Colorado State University for botanical analysis to determine percent relative density of plant fragments. Results of this analysis provided an indication of species composition of range cattle diets. The preferences described are based only on relative abundance in the diets and not on a strict comparison with availability of forage species in each pasture.

Fistulated cattle diets collected on the Lower Mahala (LM) and Middle Mahala (MM) pastures contained 96% grass or grasslike species and 4% forb species (Table 8.2). Upland grass species comprised 88% of the diet, possibly due to the few meadow areas found in these pastures. Great Basin wildrye, Sandberg bluegrass, and Thurber needlegrass were important upland species found in the fistulated cattle diets. Utilization studies (reported for these pastures in the 1982 Saval Progress Report) also indicated Sandberg bluegrass and Thurber needlegrass to be preferred species for the Saval cow herd. However, the predominant grass species in the fistulated cattle diet, Great Basin wildrye, received only slight utilization by the main cow herd. Mat muhly was the most preferred meadow species for the fistulated cattle.

The fistulated cattle diets in CC pasture contained 98% grass and 2% forb species. Great Basin wildrye, brome (most likely cheatgrass) crested wheatgrass, and Thurber needlegrass were important upland species. Bluegrass species were the predominant grass species. Field notes indicated the majority of the bluegrass species to be meadow species as the fistulated cattle preferred the loamy bottom and wet meadow range sites within this pasture. The main cow herd utilization studies on the WD pasture showed severe utilization on wet meadow and crested wheatgrass range sites. The fewer number and shorter grazing period for the fistulated cattle, as compared to the main cow herd, could explain their lighter utilization of crested wheatgrass on the CC pasture.

Fistulated cattle diets collected on the CN pasture contained 92%, 6% and 2% grass, forb, and shrub species, respectively. Brome (most likely cheatgrass) and bluegrass species were preferred grasses in this pasture. It was difficult to determine whether the bluegrass species were upland or meadow species as field notes indicated that the fistulated cattle grazed similar periods of time on upland range sites as on loamy bottom and meadow areas. Main cow herd utilization studies on USC pasture indicated moderate to heavy utilization of both upland and meadow bluegrass species. Forb consumption by fistulated cattle consisted

Table 8.2. Percent (%) relative density of discerned fragments for important species in cattle rumen samples collected on Saval Ranch pastures during 1982.

Species	Lower and Middle Mahala	Control Seeding	Control Native	South Forest Service		North Forest Service		East Darling
	Before use	Before use	Before use	Before use	After use	Before use	After use	Before use
	4/19/82	5/10/82	5/24/82	6/7/82	8/23/82	7/25/82	10/11/82	10/25/82
Grass and Grasslike								
Wheatgrass	7	11	10	7	1	3	T[1]	85
Brome	6	13	35	2	2	9	2	5
Sedge	2	1	5	46	0	65	3	T
Wildrye	30	14	5	11	16	T	7	0
Muhly	6	4	0	1	0	T	T	T
Bluegrass	28	46	33	2	4	2	40	9
Needlegrass	14	9	T	2	0	7	T	0
Other	3	T	3	0	12	5	0	0
Total[2]	96	98	92	71	36	92	53	99
Forbs								
Borage	0	0	2	T	0	0	0	0
Chenopodium	1	0	T	3	0	0	0	0
Composite	T	0	T	T	1	3	12	T
Tansy mustard	T	0	0	0	0	T	0	T
Plantain	0	0	2	0	4	0	2	0
Cinquefoil	0	T	0	23	18	3	T	0
Globe mallow	0	0	1	1	0	0	0	0
Hedge nettle	0	0	0	0	3	0	4	0
Other	2	1	0	1	15	T	T	0
Total	4	2	6	28	42	8	19	T
Shrubs								
Sagebrush	0	0	1	0	2	T	8	T
Bitterbrush	0	0	0	0	11	T	18	0
Rose	0	0	0	0	5	0	T	0
Snowberry	0	0	T	0	3	0	0	0
Other	0	0	0	T	0	0	T	0
Total	0	0	2	T	21	T	27	T

[1] T < 1%.

[2] Due to rounding and trace amounts, total values may differ from the sum of the column values.

mainly of upland species with trace amounts of meadow forb species.

South National Forest (SNF) diets of fistulated cattle collected after pasture use by the main herd showed a 35% decrease in total grass and grasslike species, as compared to the before-cattle-use diets. Upland grass species consisted of 22% of both the before- and after-cattle-use diets, however, meadow species decreased from 49% in the before-cattle use diets to 12% in the after use diets. Individual changes for the meadow species in the after use diets included a 46% reduction in sedge species and a 12% increase in rush species. Moderate to heavy utilization of sedge species by the main herd may have decreased their availability causing this reduction. The faster regrowth of rush species, as compared to sedge species, could explain the increased consumption by the fistulated cattle even after the moderate to heavy utilization by the main herd.

A 14% increase in forb consumption occurred in the after-cattle-use diets on the SNF pasture as compared to the before cattle use diets. Twelve percent of this increase was seen in upland forb consumption. Cinquefoil was the preferred forb in both diets. Heavy to severe utilization of wet and dry meadow range sites by the main cow herd apparently caused the fistulated cattle to seek a larger percentage of upland grass and forb species.

Shrub utilization by the fistulated cattle grazing the SNF pasture increased from trace amounts in the before cattle use diets to 21% in the after cattle use diets. Antelope bitterbrush was again the most preferred shrub species in the latter diet. This species was also the most preferred shrub for the similar sampling period on the early grazed National Forest pasture in 1981. Moderate to heavy utilization of preferred grass and grass-like species by the main cow herd could explain the increase in shrub consumption so early in the year.

Fistulated cattle diets collected before cattle use on the North National Forest (NNF) pasture showed a 21% increase in grass species and a 20% decrease in forb species as compared to before-cattle-use diets on the SNF pasture. The decrease in forb consumption and increase in grass consumption on the NNF pasture could be explained by the more mature (less palatable) phenology of the forb species and more palatable fall green-up of the grass species.

NNF fistulated cattle diets collected after pasture use by the main cow herd showed a 39% decrease in total grass and grasslike species, as compared to the before cattle use diets. Meadow grass species decreased 66% while upland grass species increased 28% in the after-use diets. Individual changes in meadow grasslike species in the after-use diets included a 62% reduction in sedge species. The greatest change in consumption of a grass species was a 38% increase in bluegrass (most likely Sandberg) in the "after" diet. Moderate to heavy utilization of wet and dry meadow range sites by the main cow herd and fall green-up of upland grasses could explain the reduction in use of meadow species and the increase in upland grass consumption.

An 11% increase in forb consumption occurred in the after-cattle-use diets on the NNF pasture. The increase was seen in upland forb consumption. Forbs of the composite family were preferred in both the "before" and "after" diets. Once again the main cow herd utilization of wet and dry meadow range sites apparently caused the fistulated cattle to seek a larger proportion of upland grass and forb species in their after-cattle-use diets.

Shrub utilization by the fistulated cattle grazing the NNF pasture increased from trace amounts in the before-use diets to 27% in the after-cattle-use diets. Antelope bitterbrush was again the most preferred shrub species in the latter diet. The increase in shrub consumption after pasture utilization by the main cow herd could be explained by the prior cattle utilization of preferred herbaceous species or by preference of the fistulated cattle for higher protein sources, such as shrubs, as quality of the herbaceous species declined in the fall.

Fistulated cattle diets on the ED crested wheatgrass pasture in the fall contained 99% upland grass and trace amounts of meadow grass species. Crested wheatgrass was the preferred grass species. The small percentage of meadow areas within this pasture could explain the low consumption of meadow species. The trace amounts of forb and shrub species consumed by the fistulated cattle could be explained by the low availability of palatable species within this pasture.

Diet Quality and Amount of Forage Consumed by Range Cattle

1982 Objectives:

Determine the nutritional quality and amount of forage consumed by cattle grazing Saval Ranch pastures.

1982 Accomplishments:

Forage samples collected from four rumen-fistulated and four intact cattle grazing Saval Ranch pastures were analyzed to determine nutritional quality and amount of forage consumed. The 1982 sampled pastures and rumen evacuation procedure were described in the Species Composition section of this report. The major portion of each rumen sample was sent to the University of Nevada, Reno (UNR) Nutrition Testing Laboratory and analyzed for percent crude protein, dry matter, acid detergent fiber, and lignin.

Intact steers were bolused twice daily with Chromic Oxide ($CR_2\ O_3$) in order to determine the amount of forage consumed. Fecal grab samples were collected from these animals twice daily on days 6-11 of each sampling period. The fecal samples were sent to the UNR Nutrition Testing Lab and analyzed for the same constituents as were the rumen samples in order to determine the digestibility of diets consumed. In addition, fecal samples were tested for their Chromic Oxide content. Dry matter consumed and digestible dry matter (DDM) were computed using the formulas:

$$\text{Daily DM excretion (gm)} = \frac{\text{gm } Cr_2O_3 \text{ fed daily}}{Cr_2O_3 \text{ per gm feces}}$$

$$\text{Daily DM consumption (gm)} = \frac{\text{(lignin per gm feces) (daily DM excretion)}}{\text{lignin per gm forage}}$$

$$\text{DDM} = \frac{\text{(daily DM consumption) - (daily DM excretion)}}{\text{daily DM consumption}}$$

where DM = dry matter and gm = gram.

Forage crude protein (CP) levels increased from 10% in the LM and MM pasture diets to 17% in the CC and CN pasture diets (Table 8.3). The lower CP content contained in the earlier grazed LM and MM diets could be explained by the lower availability of current year growth in this pasture due to cold temperatures in March and April. Crude protein content reached its highest level in the South National Forest before-cattle-use diets when grass and grasslike species were at the prebloom to bloom phenologic stages. Crude protein content in diets collected from later (July-October) grazed pastures decreased as grass and forb species matured. Overall, protein level in the cattle diets would appear to meet a range cow's protein requirement with the exception of the ED pasture diets. However, as this is not a critical nutritional period, protein supplementation is not recommended at this time.

As expected, there was an inverse relationship between CP and acid detergent fiber (ADF). Acid detergent fiber levels were at their highest in the earliest and latest grazed pasture diets as little green plant material was available for consumption. Cattle diets collected after the early SNF diets, increased in ADF due to the maturation of grass and forb species. Plant material becomes more fibrous upon maturity.

Grazing animal diets increased in lignin content in the pastures grazed during July-October. Percent lignin was higher in the later sampled diets as lignin gradually increases with plant maturity. In the National Forest pastures, where samples were collected before and after utilization by the Saval cow herd, percent lignin was higher in the after-cattle-use diets. This could be due to the greater percentage of forb and shrub species within these diets. Forb and shrub leaves are typically more lignified than grass leaves and stems.

Percent digestible crude protein (DCP), like total crude protein, decreased in the July-October fistulated cattle diets. Diets collected from the second grazing periods on the National Forest pastures also contained less DCP and digestible dry matter (DDM) than was contained in diets collected from the earlier grazing periods on each respective pasture. The lower digestibility in the later diets coincided with a higher percent ADF and lignin content. This may be explained in that lignin and fibrous fractions of the forage interfere with the digestibility of nutrients, including protein.

Chemical analysis to determine cattle intake was not completed in time for this report. These results will be reported in the 1984 report.

Table 8.3. Chemical analysis and calculated digestibility from rumen and fecal samples collected on Saval Ranch pastures during 1982.

Area	Sampling period	Chemical tests: Total crude protein	Chemical tests: Acid detergent fiber	Chemical tests: Lignin	Digestibility: Digestible crude protein	Digestibility: Digestible dry matter
		%	%	%	%	%
Lower &Middle Mahala	4/19/82	10.4	46.4	8.9	4.4	35.6
Control Seeding	5/10.82	17.2	34.6	4.6	10.8	52.8
Control Native	5/24/82	17.3	33.5	5.3	10.6	60.9
South National Forest (before)	6/7/82	20.8	28.1	4.1	11.0	51.4
South National Forest (after)	8/23/82	13.5	40.0	7.9	6.0	47.0
North National Forest (before)	7/25/82	13.6	35.1	3.5	8.1	63.1
North National Forest (after)	10/11/82	10.6	43.2	7.4	4.3	48.8
East Darling	10/25/82	6.1	46.3	12.1	2.2	46.4

CHAPTER 9

EVALUATION OF THE LOWER SHEEP CREEK SEEDING

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BACKGROUND AND PURPOSE

The Lower Sheep Creek Seeding was established in the fall of 1981 by plowing suitable areas in the pasture with rangeland plows pulled by crawler tractors and then seeding desired plant species using rangeland drills. Suitability of areas to be plowed and seeded was based on several criteria: (1) Soil and slope suitability: The BLM Elko District Soil Scientist recommended that certain soil mapping units not be treated because of their limitations, primarily those of excessive salts in surface horizons. Slopes of over 20% were excluded from treatment because of potential erosion problems. (2) Archaeological values: Areas having archaeological values were designated by the Elko District Archaeologist prior to treatment and these sites were excluded. (3) Wildlife values: Areas having exceptional or unique wildlife values were excluded from treatment. Such areas included a sage grouse strutting ground and wintering habitat as identified by Nevada Division of Wildlife (NDOW) and University of Nevada, Reno (UNR) personnel. (4) Aesthetic value: Areas having aesthetic value, such as along the state highway, were generally avoided. The treated area was not laid out in blocks, but rather in an irregular fashion to appear more natural. (5) Private lands were avoided as far as possible.

The objectives of the seeding were as follows:

(1) Improve quantity and quality of early spring forage for livestock use. This would be done by plowing and seeding vegetation in poor (low seral) range condition that would otherwise take an unacceptably long period of time to recover naturally. A newly seeded pasture would allow implementation of a grazing system on several older seeded pastures. This would be expected to allow some recovery of the older seedings which were deteriorating in productivity.

(2) Provide for a longer season of use on the seeded pastures. This would provide for later turn-in dates on native BLM and National Forest pastures, and thus allow for recovery of native vege- tation and wildlife values in these areas. It would also provide for implementation of a grazing system in which at least one BLM pasture would be rested from all livestock grazing use each year.

The plowing and seeding operations were conducted in October, November, and early December, 1981. Approximately 2,340 acres were treated. Sage-

brush control on the treated areas was about 70% effective. Seeding rate was approximately 11 pounds per acre (Table 9.1).

A major problem encountered during the final two weeks of seeding was frozen ground early in the morning. This led to reduced stand establishment in some locations. In July, 1982, an evaluation was made of overall success of the seeding, and this information was presented in the April, 1983 Progress Report. Approximate acreages for each success-rating category were as follows: Excellent, 220; Good, 430; Fair, 1530; and Poor/Failure, 250. Favorable climatic conditions during 1983 appeared to enhance the stand success. An evaluation similar to that made in 1982 will be made in 1984 to determine whether the stand has actually improved.

VEGETATION RESPONSE

Estimate of Carrying Capacity

In August, 1983, BLM Elko District personnel evaluated the Lower Sheep Creek (LSC) seeding to determine production by species and to make recommendations about livestock stocking capacity. The sampling procedure used was the Estimating and Harvesting (Double Sampling) Method described in the National Range Handbook (1976).

Sampling areas were selected at random by driving along roads traversing the seeding, stopping at predetermined speedometer readings, and running a line transect at right angles to the road being travelled. A 9.6 ft^2 hoop was used and ten plots were evaluated along each line transect. Forage weight was estimated for at least two plots on each line transect prior to harvesting and weighing. Only weight estimates were recorded on the other plots. A correction factor was obtained by dividing the harvested weight by the estimated weight to find the corrected weight for each species in all plots. Elko District information from previous range inventories was then used in determining percent air dry weight, phenological adjustment factor, and proper use factor for each species in order to obtain total utilizable forage. The information obtained was then converted to utilizable pounds of forage per acre, pounds of forage required per AUM, and tallied based upon total acreage present. Utilizable forage information for LSC Seeding is summarized in Table 9.2.

Nevada BLM districts use a figure of 800 pounds forage required to support one AUM. With a total seeding area of about 2,430 acres at 260 lbs./acre utilizable forage, the recommended stocking rate on the seeding would be about 3 acres/AUM or 810 AUM's. Using an estimated total of 4,600 acres for the LSC Pasture and an original stocking rate of 310 AUM's for the entire pasture (pre-treatment), the original carrying capacity was about 15 acres/AUM. Approximately 2,170 acres in the pasture were not treated. This amounts to about 145 AUM's for the untreated portions. Thus, total stocking rate for the LSC Pasture would be approximately 955 AUM's, an increase of 645 AUM's.

Species Composition

Permanent transects in LSC Pasture were located in six of the areas sampled in 1982 to evaluate the seeding success. All transects were

Table 9.1. Species seeded and application rates for Lower Sheep Creek Seeding, 1981.

Species	Pounds per acre
Nordan crested wheatgrass	5
Pubescent wheatgrass	2
Russian wildrye	2
Yellow Sweetclover	1
Ladak alfalfa	0.33
Small burnet	0.33

Table 9.2. Utilizable forage, Lower Sheep Creek Seeding, 1983.

Seeded Species	Utilizable Production (lbs/acre)
Nordan crested wheatgrass	144
Pubescent wheatgrass	96
Ladak alfalfa	0.5
Small burnet	0.5
Yellow sweetclover	3
Russian wildrye	Trace
Nonseeded Species	
Sandberg bluegrass	6
Squirreltail	10
Indian ricegrass	Trace
Basin wildrye	Trace
Total	260 lbs/acre

sampled for species frequency and ground cover characteristics. Shrub canopy cover and density were also sampled on temporary transects on 42 additional sites in the seeding. Density and canopy cover of shrub species were sampled by the belt transect and line intercept methods, respectively, on ten, 49.2 ft. transects.

Shrub cover, density, and frequency data on transects in the LSC Seeding and the seeding success rating for each area are shown in Table 9.3. Since sagebrush cover on sites with poor success rating is similar to that on sites with good or excellent rating, some factor other than brush control was responsible for seeding failure in these areas. Of the two sites rated poor, one was on a south slope with a dense stand of cheatgrass. The other site was drilled but little or no seed was in the seed box or seed was not properly distributed. Other seeding failures resulted from lack of brush control, drilling on frozen soil, and seeding sites with unfavorable soil properties. Shrub crown cover on temporary transects ranged from 1% to 20%. Crown cover was 10% or less on 34 of 42 sites and 5% or less on 23 sites. Shrub density ranged from 900 to 18,000 shrubs per acre. The shrubs present on most fair, good, and excellent grass stands probably do not compete with forage species. However, these shrubs do represent a large potential seed source for reinvasion of this seeding. Vegetation monitoring will evaluate the effects of a 3-pasture deferred-rotation grazing plan on the stability of the present shrub-grass complex.

1983 GRAZING USE

Grazing of the LSC Pasture was deferred until the fall of 1983, following two full growing seasons, the minimum time period allotted for the seeding to become established. Grazing was allowed for two reasons: (1) To facilitate livestock movements off National Forest lands to the wintering area at the Haystack Ranch. Moving the herd to one of the seeded Darling pastures would have been a more complex and time consuming move. (2) Hopefully, livestock use would promote future establishment of desirable forage species by scattering and trampling in seeds.

Livestock were turned into the pasture beginning October 1, 1983 and turned out on November 16, 1983. A total of 716 head used 1,098 AUM's of forage during this period. A range utilization estimate was made midway through the grazing period. Utilization ranged from slight (1-20% of available forage removed) to light (21-40% removed). Based on these observations, the cattle were allowed to remain until November 16, 1983. No estimates of utilization were made following livestock removal because of heavy snow accumulation.

LIVESTOCK STUDIES

Prior to turn-in of the cattle on October 1, 1983, the LSC Pasture was used for a livestock grazing trial by rumen-intact and fistulated cattle for a period of 10 days to evaluate diet quality and intake. The methods used in obtaining these data have been previously described in Chapter 8 of the April 1983 Progress Report.

Table 9.3. Shrub ground cover, density, and frequency (20 x 20 in. frame) by species* on six sites of various stand success ratings in the Lower Sheep Creek Seeding.

Success Rating	$\bar{X}$ Density (No./Acre)					$\bar{X}$ Crown Cover (%)					$\bar{X}$ Frequency (%)			
	Arlo	Artr	Chna	Chvi	Total	Arlo	Artr	Chna	Chvi	Total	Arlo	Artr	Chna	Chvi
Excellent	0	510	0	1,480	1,990	0	1	0	2	3	0	6	T	10
Good	2,020	240	0	300	2,560	2	0	0	T**	3	18	2	0	4
Fair	0	1,700	30	3,530	5,260	0	4	T	3	7	0	12	T	22
Fair	2,130	460	0	10,470	13,060	6	T	0	8	14	18	4	2	45
Poor	0	2,000	80	860	2,940	0	3	0	T	3	0	14	T	4
Poor	0	860	0	430	1,290	0	2	0	T	2	0	8	2	1

*Arlo = Early sagebrush

Artr = Big sagebrush

Chna = Rubber rabbitbrush

Chvi = Low rabbitbrush

**T = Trace = <0.5%

Following removal of the main herd, the grazing trial was to be rerun for a second period of 10 days. However, the trial was terminated on the third day because of heavy snow and cold weather.

Prior to turn-in of the main livestock herd, the research steers spent 56% of the grazing time in the seeded area, 42% in loamy bottom areas, and 2% in miscellaneous types. Laboratory results on diet composition and quality were not available for inclusion in this report.

WILDLIFE RESPONSE

Sage Grouse

An important consideration in vegetation manipulation is potential disturbance to areas having exceptional or unique value to wildlife. Prior to the seeding operation, NDOW had located a sage grouse strutting ground in LSC Pasture (Strutting Ground #1). The highest count recorded on this ground during the intensive count period since 1979 was 6 males, only 2% of the total male count on the allotment in 1979.

A buffer zone of undisturbed vegetation around the strutting ground was left to mitigate impacts. However, no male sage grouse were observed on Strutting Ground #1 the first spring (1982) following the treatment. Again in 1983, no male sage grouse were observed. Based on this information, the conclusion would be that sage grouse responded negatively to the seeding. However, strutting grounds #'s 2 and 9, located outside of LSC Pasture, also had zero counts in 1982 and 1983. Strutting Ground #9 had a zero count in 1981 as well. As described in Chapter 4 of this report, the sage grouse population declined from 1979 to 1982 with a slight increase recorded in 1983. Six of ten strutting grounds had steady declines during 1979-1982. The other four grounds fluctuated up and down, but three of the four had lower counts in 1983 than in 1979. In view of the 60% decline in total males between 1979 and 1982, a zero count on the smaller grounds was not unexpected.

At this point in time, the impact, if any, of the mixed species seeding on strutting ground activity cannot be determined. If the population increases over the next few years and males begin using Grounds #2 and #9 again but not #1, then the treatment would appear to have a negative impact.

Another concern was the impact on nesting, most of which occurs in a 2 mile radius around strutting grounds (Gill 1965, Martin 1970, Wallestad and Pyrah 1974), depending on the availability of quality nesting habitat. The extent of nesting in LSC Pasture was not determined prior to the seeding operation, but sagebrush cover in the 20-40% range most frequently selected for nesting (Patterson 1952, Klebenow 1969, Wallestad and Pyrah 1974) remains available.

An estimate of habitat use in LSC Pasture prior to the seeding was based on dropping counts conducted in each vegetation type (Barrington et al. 1982). Although dropping counts do not indicate the season of use, the activity for which the habitat is used, or the significance of habitats

used during critical weather conditions, they can be used to rank cover types in terms of relative amount of time they were inhabited by sage grouse.

Of 33 vegetation types identified in LSC Pasture before seeding, only 8 had dropping counts that exceeded 100/acre. The 8 types accounted for approximately 1,340 acres or 30% of the total area. Less than half of the area included in these vegetation types was treated (Table 9.4), although some vegetation types were completely eradicated and others were not plowed at all.

Other factors indicate that LSC Pasture was used as a wintering area. (1) The habitat is considered poor quality summer habitat, based on the low availability of forbs (Barrington et al. 1982). (2) The vegetation types with high dropping counts were similar in species composition and canopy coverage (with the exception of the Wet Meadow type) to other winter habitats on the Project area. (3) As part of the planning process, NDOW, UNR, and BLM personnel previously classified particular areas of the pasture as winter grounds.

Observations the first winter (1982-83) after the seeding was established and again in winter 1983-84, indicated that sage grouse were using LSC Pasture. Flocks of 5-30 birds were observed using both treated and untreated areas of the pasture. Roost and loafing sites were in big sagebrush-low rabbitbrush types (unplowed). Feeding was observed on residual big sagebrush in the treated areas and to a lesser extent on big sagebrush on unplowed, south-facing slopes. The small amount of alkali sagebrush left unplowed was snow covered and unavailable when sage grouse moved into the pasture.

Since only about 40% of the "high use" vegetation types were impacted by the seeding operation (Table 9.4), some winter use of LSC Pasture was expected. However, use of the residual sagebrush in the treated areas was not anticipated. Shrub cover (above the snow) averaged 2% and shrub density averaged 1,800 stems/acre at feeding sites in the treated area. This is much less than the 20% or greater shrub cover reported for sage grouse winter cover (Eng and Schladweiler 1972, Schoenberg 1982).

Whether feeding in the treated areas is a short-term response brought about by a nutrient release or a long-term response resulting from other physiological changes in the shrubs is currently being studied.

Overall, the impact of the seeding on sage grouse numbers, movements, and habitat use is believed to be minimal. This is due to the mosaic pattern of the plowing, the target of only 70% shrub removal in plowed areas, and avoidance of some known winter habitats. The long-term effect may actually be beneficial if the seeded and native forb production increases in future growing seasons.

Nongame

Rodents. Methods for sampling rodent populations and their habitats are discussed in Chapter 6 (Nongame Wildlife). Rodent abundance indices are expressed as mean number of first-time captures per 400 trap-nights.

Least chipmunks showed the most obvious response of rodents to plowing and seeding of LSC Pasture. Their abundance index decreased from a mean value of 15 animals in 1981 (before seeding) to approximately 1 each in 1982 and 1983 (Fig. 9.1). During this same period, chipmunk abundance did not change significantly ($p<0.05$) on the untreated (Upper Sheep Creek Pasture) area. Combining data from 1982 and 1983 (post-seeding years), there were significantly fewer chipmunks ($p<0.05$) on the seeded area than on the untreated area.

The reduction of chipmunks after seeding and their lower abundance on the seeding as compared to the untreated area is apparently due to the reduction in shrub cover brought about by plowing when the seeding was established. Estimated shrub canopy cover was 4.3% after brush control, compared with 27.2% on the untreated area (significantly different at $p<0.001$). Shrub cover in the area of our rodent sampling grids in LSC Pasture before treatment was approximately 30% (Barrington et al. 1982), similar to the present untreated areas. Least chipmunks have been referred to as sagebrush obligates (McAdoo and Klebenow 1979), apparently requiring shrub structure for cover and sentinal perches. Thus, it seems logical that reduction of shrub cover would result in a decrease in chipmunk abundance.

During 1983, an older crested wheatgrass seeding (Darling Seeding) was sampled for comparative purposes. With shrub canopy cover of 10.4%, chipmunk abundance was closer to that of the untreated area than that of the new seeding (Fig. 9.2). Apparently, sagebrush invasion of the older seeding provided the necessary shrub cover for chipmunk populations. This relative abundance of chipmunks indicates that leaving approximately 10% shrub cover would provide suitable habitat for this species. Also, when near complete shrub removal occurs for the purpose of intensive livestock production, chipmunk populations apparently have the potential to bounce back as sagebrush reinvades over the years.

Results of a companion study in central Nevada at the Gund Research and Demonstration Ranch showed a similar relationship between least chipmunks and shrub cover. Chipmunk abundance on an untreated area with 18% shrub cover was more than double that on a partially sprayed area with 11% shrub cover (McAdoo, unpubl.).

It must be emphasized that short-term results of rodent trapping may sometimes be misleading in terms of measuring population response to habitat manipulation. It is particularly important that rodent studies be long-term and have adequate controls in order to discern valid responses from annual or cyclic population fluctuations.

The mountain vole is an excellent example of a species whose population change could easily have been interpreted as a response to habitat change brought about by the treatment. Mountain voles were nonexistent (or at least untrapped) on both the untreated area and the seeding area during 1981 (before seeding) and 1982 (the first year after seeding). Then, in what <u>could</u> be interpreted as a delayed response to increased herbaceous cover, voles increased significantly ($p<0.05$) on the seeding in 1983 (Fig. 9.3). However, vole populations had also been sampled during the same three years in an ephemeral creek bottom which dissects the new

Table 9.4. Extent of plowing in vegetation types used heavily by sage grouse in Lower Sheep Creek Pasture, Saval Ranch.

Vegetation #/Type[1]		Dropping count/acre	Total acres	Acres treated	Percent treated
13b	ARTR/CHVI/POSA-60% ARLO/POSA-40%	500	30	30	100
48	Wet meadow	312	3	0	0
14	ARTR/CHVI/ELCI	263	7	0	0
2	ARLO/POSA-90% ARTR/CHVI/POSA-10%	263	202	44	22
3a	ARLO/POSA-80% ARTR/CHVI/POSA-20%	178	925	389	42
49	ARTR/BRTE	137	17	0	0
13a	ARTR/CHVI/POSA-70% ARLO/POSA-30%	137	79	68	86
3b	ARLO/POSA-60% ARTR/CHVI-40%	111	81	5	6
	Total		1344	536	40

1/ Key to names:
ARLO = alkali sagebrush
ARTR = big sagebrush
BRTE = cheatgrass brome
CHNA = rubber rabbitbrush
CHVI = low rabbitbrush
ELCI = Great Basin wildrye
POSA = Sandberg bluegrass

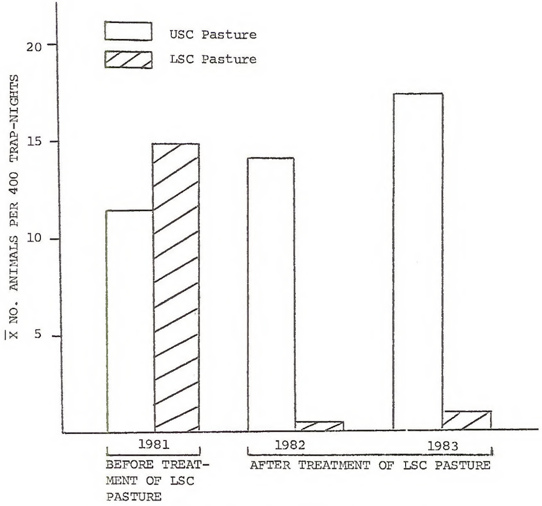

Fig. 9.1. Comparison of least chipmunk abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

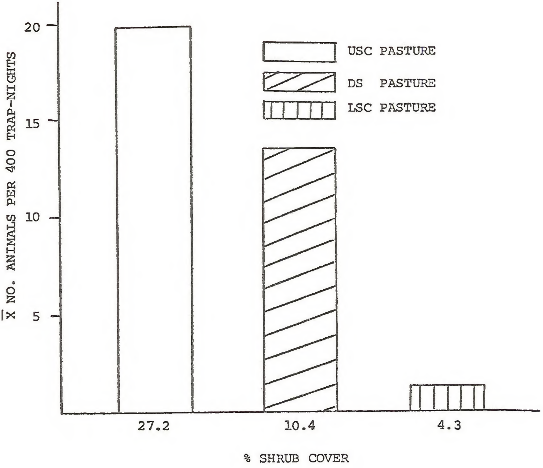

Fig. 9.2 Comparison of least chipmunk abundance during 1983 in an untreated sagebrush habitat (USC Pasture), a sagebrush-invaded seeding (DS Pasture), and the recently treated area (LSC Pasture.

seeding. The vegetation adjacent to this creek was left intact as a buffer zone. Mountain voles were indigenous to this habitat, but not abundant until 1983 (Fig. 9.3.) when their population increased significantly ($p<0.001$). This increase was almost exponential, with mean abundance values going from 3.7 and 8.0 in 1981 and 1982, respectively, to 163 in 1983. However, this dramatic increase was apparently part of a cyclic phenomenon, as evidenced by high vole populations reported throughout Elko County (personal communication with Range and Pasture Specialist, Irv Hackett), and even as far south as the Gund Ranch in central Nevada. Results from the ephemeral drainage site, coupled with this outside information, have led to the conclusion that the seeding was merely providing marginal habitat for a vole population that had expanded out of its natural boundaries.

The deer mouse is a good example of a rodent species which was relatively unaffected by plowing and seeding of LSC Pasture. There was no significant difference in abundance among years in either the treated or untreated sites ($p<0.05$). In fact, deer mouse abundance was similar for the two sites both before and after plowing and seeding (Fig. 9.4).

Species richness (total number of species) of rodents was similar for both the treated and untreated pasture: five to seven species each year in the untreated pasture, compared with five to six species each year in the seeding. One possible consequence of the seeding was the disappearance of the northern grasshopper mouse from the seeded area. However, this species was recorded at such low abundance levels on both the untreated pasture and LSC Pasture before seeding that no valid statistical tests could be made. Experience at the Gund Ranch in central Nevada indicates that this species will inhabit altered habitats within three years after range improvement takes place.

The next step in the evaluation of the LSC Seeding on rodent populations will be to determine if any change in total rodent biomass occurred. Because of the large size (approximately 1.5 ounces) of least chipmunks relative to the other rodents on the seeding, the decrease in chipmunk abundance which resulted from shrub reduction may well have temporarily caused a significant reduction in rodent biomass. However, the key word here is "temporarily," since our data indicate that chipmunks will increase in response to sagebrush invasion. There have been some general statements in the literature that changes in prey base brought about by shrub removal and seeding have the potential of affecting predators, especially raptors (Call 1979, Craighead and Mindell 1981).

Birds. Methods for sampling nongame birds and their habitats are discussed in Chapter 6 (Nongame Wildlife). Relative abundance of birds is expressed as mean number of birds detected per transect-day. Comparisons in the following discussion will be primarily between 1981 (pre-seeding) and 1983 (two years after seeding), although data for 1982 will be given in the figures.

The most discernible responses of the bird community to plowing and seeding were a slight decrease in shrub nesting species and an increase in ground/grass nesting species. The following discussion emphasizes the effects of habitat alteration on the five most abundant species encoun-

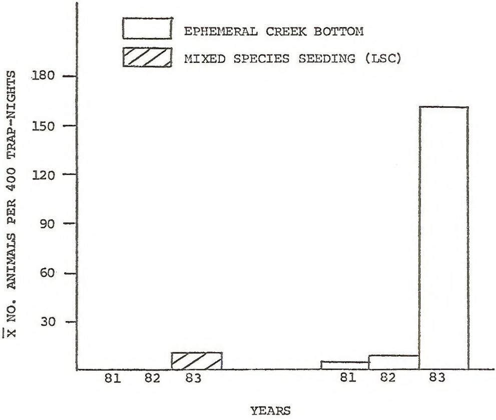

Fig. 9.3. Comparison of mountain vole abundance in an ephemeral creek bottom habitat and in a newly established mixed species seeding (LSC Pasture).

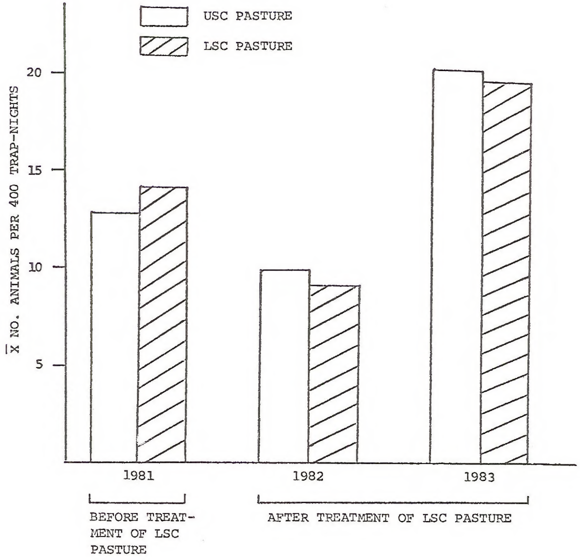

Fig. 9.4. Comparison of deer mouse abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

tered on transects: two shrub nesting species (Brewer's sparrow and sage thrasher) and three ground/grass nesting species (horned lark, meadowlark, and vesper sparrow).

We expected a decrease in Brewer's sparrows in response to the reduction of shrub cover brought about by plowing of LSC Pasture. Brewer's sparrows are considered sagebrush obligates, requiring shrub structure for a nesting substrate (Braun et al. 1976, McAdoo and Klebenow 1979). This species did decrease significantly ($p<0.05$) after brush control, from 13 birds per transect day in 1981 to 8 in 1983 (Fig. 9.5). However, this decrease seems slight compared to the extent of sagebrush reduction. Estimated shrub canopy cover after plowing was 6% in the area of our bird transects, compared with 19% along the bird transects in the untreated pasture. Shrub canopy cover in the area of our bird transects in LSC Pasture prior to treatment may have actually been as high as 30% (Barrington et al. 1982). During the same time that Brewer's sparrows decreased as a result of shrub removal, they showed no significant change in the untreated pasture.

The response of sage thrashers to brush control was not as clear as that for Brewer's sparrows. Abundance of this species increased significantly ($p<0.05$) on both the seeding and untreated area between 1981 and 1983 (Fig. 9.6). However, the rate of increase was lower on the seeding than on the untreated area, indicating that the factor(s) responsible for the increase may have been partially offset by brush control and seeding of LSC Pasture. In fact, sage thrasher abundance was significantly lower ($p<0.05$) in the seeding than in the untreated pasture in 1983. There was no significant difference in sage thrasher abundance between the two pastures in 1981 (before treatment). We have tentatively concluded that shrub reduction on the seeding was slightly detrimental to sage thrashers.

Sage thrashers are also considered to be sagebrush obligates (Braun et al. 1976). They prefer taller sagebrush (>36 inches) as nest sites (Castrale 1982). Some of the shrub cover which remained after plowing apparently continued to provide suitable nesting cover for these birds.

The horned lark, a ground nesting species, responded favorably to the establishment of the seeding. Abundance of this species increased significantly ($p<0.05$) from 6 birds per transect-day before seeding, to 14 in 1983 (Fig. 9.7). During the same period, horned lark abundance on the untreated site did not change significantly. Horned larks nest on the ground in open areas and are reportedly most common in disturbed grassland habitats (Kendeigh 1941). These birds responded inversely to shrub reduction, or, put another way, positively to the "openness" brought about by shrub reduction.

The western meadowlark, a grass nesting species, also responded favorably to establishment of the LSC Seeding. Meadowlarks increased significantly ($p<0.05$), almost eight-fold, from 1981 to 1983 (Fig. 9.8). During this same period, these birds also increased significantly on the untreated areas, though not at as high a rate. It is also interesting to note that meadowlarks increased on both the untreated area and the seeding in 1982 (the first year after seeding). However, in 1983, meadowlark abundance leveled off in the untreated area, but continued to increase in the seed-

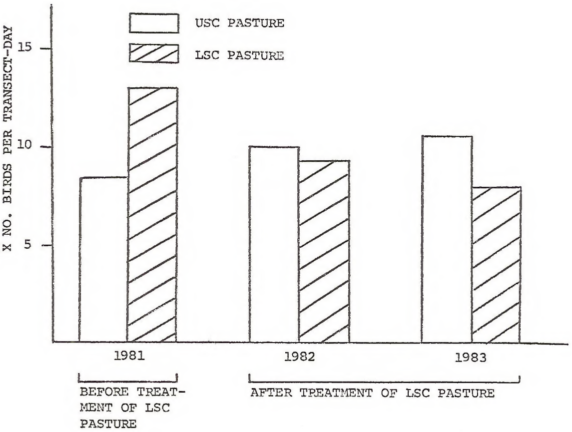

Fig. 9.5 Comparison of Brewer's sparrow abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

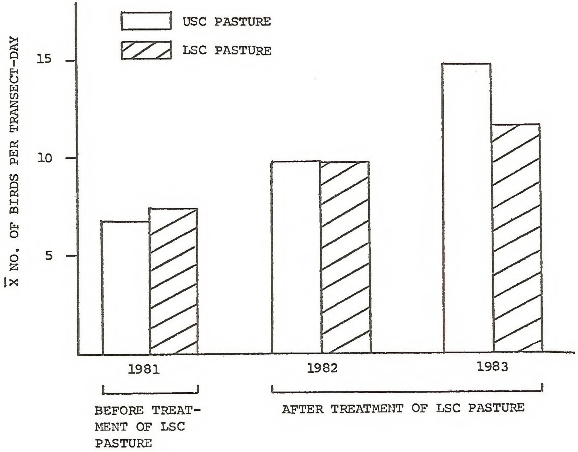

Fig. 9.6. Comparison of sage thrasher abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

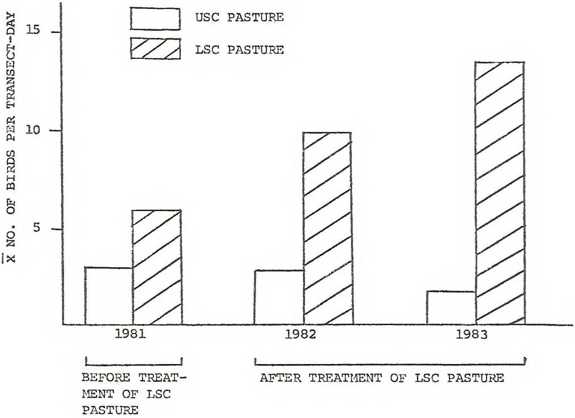

Fig. 9.7. Comparison of horned lark abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

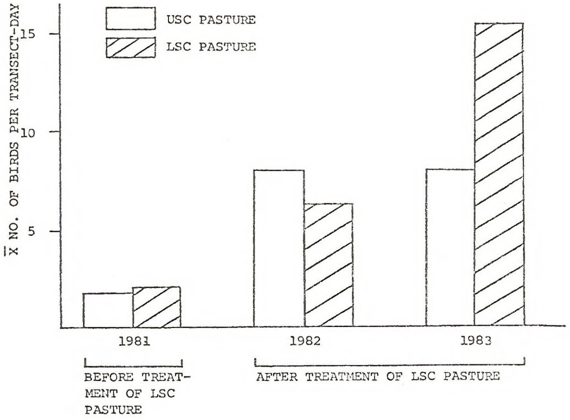

Fig. 9.8 Comparison of western meadowlark abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

ing. This may have been a delayed response of meadowlarks to the gradual increase in herbaceous cover on the seeding. Wiens and Rotenberry (1981) and Castrale (1982) have reported that meadowlarks tend to be more abundant where perennial grass cover is greater. The fact that the seeded species are introduced rather than native may be of little consequence for nesting, since birds are adapted to life form of vegetation rather than species composition (Odum 1945, Johnsgaard and Rickard 1957).

Vesper sparrows were another common grass nesting species encountered in both the seeding and untreated pasture. This species did not change significantly ($p < 0.05$) in abundance over time on the seeding (Fig. 9.9). However, the apparent upward trend in response to the seeding may become significant if the herbaceous cover continues to increase. Like meadowlarks, vesper sparrows typically increase in abundance with increasing grass cover (Wiens and Rotenberry 1981, Castrale 1982).

Species richness (total number of species) was similar for both the seeding and the untreated pasture. Seven to eleven nesting species were recorded each year for transects in the untreated pasture, compared with eight to eleven species recorded each year on transects in the seeding. There was, therefore, no obvious effect of shrub reduction and mixed species seeding on species richness of birds. Apparently, the remnant shrubs in the seeding, as well as shrubs left in "buffer zones" along the ephemeral creek bottom and ridgetops, provided the structure for the habitat diversity required by a variety of bird species.

Other Wildlife

A change in vegetative composition, cover, and density of the magnitude resulting from the plowing-seeding of LSC Pasture can be expected to be beneficial to some species and detrimental to others. As the food/cover base is changed, the species of primary and secondary consumers may change, but the links in the food chain remain.

The ability to document these changes in a statistically valid manner is contingent upon the manpower resources available. The Saval Project was planned to evaluate impacts on major species or communities, realizing that every species could not be studied in detail. However, project personnel maintain records of sightings of new or rare species or observations of species in different vegetation types or land areas. Although the scientific merit of these observations is limited, they do provide an index of change, and therefore, help clarify the biological picture. This section is based on the chance field observations of the research staff.

Prior to 1982 pronghorn antelope were observed on the Saval Ranch infrequently or during periods of migration to and from winter ranges. In 1983, a large buck, a buck and doe, and two small bucks were observed throughout the summer in LSC Pasture and occasionally on the Darling Seeding.

Yoakum (1980) reviewed several range improvement projects and their value to pronghorn. Seedings that resulted in grass monocultures had little benefit to pronghorn. Mixed-species seedings or operations that

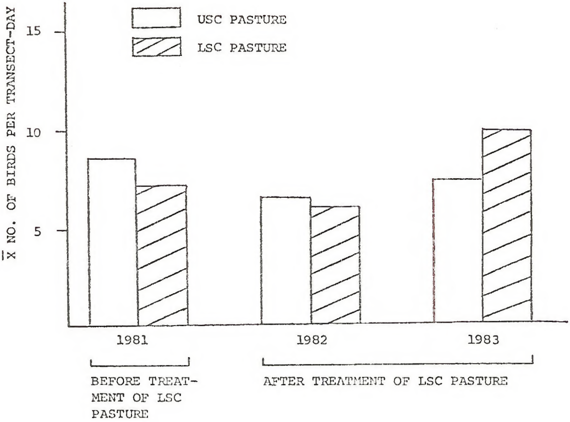

Fig. 9.9. Comparison of vesper sparrow abundance in an untreated sagebrush habitat (USC Pasture) with that in a similar site (LSC Pasture) before and after treatment.

increased forb production were beneficial to pronghorn. Autenrieth (1978), Salwasser (1980), and Yoakum (1980) stressed maintenance or restoration of a diverse herbaceous community as an important pronghorn management practice. Therefore, if the native and seeded forbs increase in abundance on the LSC Seeding, the pronghorn response should continue to be favorable.

In conjunction with the seeding, a small pond was rehabilitated and the spring source and associated meadow were fenced. Several waterfowl species and shorebirds used this pond. An island created for Canada goose nesting was visited by geese, but no nesting attempt was made. Green-winged teal, cinnamon teal, pintails, red heads, mallards, gadwalls, lesser scaup, eared grebe and Wilson's phalarope were some of the species observed using the pond area.

HYDROLOGIC RESPONSE

Sheep Creek is an ephemeral stream that flows from spring through early summer in most years. The main channel of the creek travels approximately 2.5 miles through LSC Pasture before leaving the project and feeding into the North Fork of the Humboldt River. Although the main channel was not disturbed by the seeding operation, many of the intermittent drainages that drain into Sheep Creek were plowed and seeded.

Stream flows and suspended sediment have been monitored on Sheep Creek since the spring of 1979. Monitoring was conducted above the seeding, in LSC Pasture, approximately 0.3 miles downstream from the Upper Sheep Creek fenceline, and below the seeding, where the creek crosses Mountain City Highway. Stream flows were measured manually, approximately once a week during the seasons of flow, using a horizontal cup-type meter. In addition depth integrated sediment samples were taken. This provided three seasons of data before the and two seasons of data after the seeding was established.

To ascertain any changes in the sedimentation processes, it is necessary to have a few more seasons of data. This is because erosion and sedimentation are natural processes subject to great natural variation. Evaluating the effect on flows and water quality requires determining a pre-treatment sediment budget or stream flow-sediment load relationship between upstream and downstream sites, then comparing this to the post-treatment sediment budget relationship. This will provide an idea of how the flow-sediment relationship has changed between the sites due to the seeding. This procedure has not been completed at the time of this report. However, preliminary results indicate that there may have been a change in suspended sediment carried from the seeding.

ECONOMICS

The results of an economic analysis of the LSC Seeding are taken from a paper presented at the Crested Wheatgrass Symposium held October 3-7, 1983 in Logan, Utah (Torell in press). The interested reader is referred to the symposium paper for a more complete discussion of the economics of the project. Only a summary of the results and procedures is provided here.

The economic analysis of the LSC Seeding includes "expected" benefits and costs (except for range improvement implementation costs which represent levels actually incurred) and as such reflects an "ex ante" analysis. Only livestock benefits are considered.

Production costs, grazing/hay resources, "typical" livestock production practices, and production levels were obtained for the Saval Ranch (Torell et al. in press) and were used to develop a profit maximizing linear programming (LP) model. To determine the benefits and impacts of developing the mixed-species seeding on the Saval Ranch, several alternative management scenarios were considered. First, a scenario (i.e., LP run) was established which reflected optimal (profit maximizing) production without the new 2,340 acre seeding. This scenario established a benchmark against which other scenarios reflecting optimal livestock production with the new seeding could be compared. The resulting difference in net returns reflects the estimated net annual livestock benefit from adding the seeding when traditional grazing patterns are followed. This net annual benefit was assumed to accrue every year over a 50 year planning horizon. After discounting this flow of returns to present value, the cost of the seeding and the cost of the purchased livestock were subtracted, and the present net worth of the seeding was estimated.

Two alternative scenarios were considered for traditional season-long grazing patterns. First, the economics of the new seeding was considered when winter feed (hay) was the limiting factor of production. This reflects the existing situation on the ranch. As a second scenario, the option of fertilizing hayland on the ranch was considered. It was estimated that one-third of available hayland (564 acres) on the ranch could potentially be fertilized (Torell et al. in press). Hay yields on fertilized acres would be expected to increase by 1.25 tons/acre. The cost of the fertilization program was estimated to be $40/acre.

The economics of the Saval Ranch grazing system was considered using similar procedures as outlined above for traditional season-long grazing patterns. That is, a benchmark scenario was established which reflected optimal production without the grazing system. Selected years of the grazing system were then simulated to estimate optimal livestock production. For the grazing system analysis, it was assumed that one-third of available hayland was already being fertilized (as outlined above), and range forage was the limiting factor of production.

Range Improvement Costs

Range improvements amounting to an estimated $149,381 have been implemented on the Saval Ranch since 1981 (Torell et al. in press). Over half of this expense ($78,204) was for implementation of the new 2,430 acre mixed-species seeding. Other improvements include new fence construction, fence reconstruction, and water developments (see Torell et al. in press). In addition, it was estimated that an additional $43,545 of water developments may need to be implemented as a part of the proposed Saval grazing system, bringing total expenditures for range improvements to an estimated $192,926 (Torell et al. in press). Maintenance costs of these improvements were estimated to be about $2,400 per year.

The costs incurred in the treatment are enumerated in Table 9.5. The total cost is estimated to be $32.18 per acre. Seed cost of $10.70 per acre accounts for one-third of this expense. This expense is considerably higher than if a monoculture of crested wheatgrass had been planted. Planting the additional species increased cost by $7.30 per acre. This means that the cost of the seeding was increased by 29 percent to avoid planting a crested wheatgrass monoculture.

Results

Traditional Grazing Patterns--Hay Limiting. When hay acreages are not fertilized, such that winter feed limits livestock production, optimal herd size would be 670 brood cows (Torell et al. in press). With the addition of an estimated 972 AUM's from the seeding, and with all other grazing resources held constant, optimal herd size was estimated to increase to 734 brood cows. Management as a cow-calf/yearling operation with all steer calves carried over for sale as yearlings was estimated to maximize profit.

Gross benefits from the seeding were estimated to be $22,991 (Table 9.6). Annual production costs were estimated to increase by $16,047. The resulting net annual livestock benefit is then estimated to be positive. However, this does not include the cost of the seeding or the cost of additional brood stock purchased in order to utilize the additional forage. After discounting the 6,944 annual flow of returns to present value, the cost of the project and purchased livestock were subtracted. The resulting net present value was estimated to be minus $20,167 (Table 9.6). The internal rate of return was estimated to be 6.26 percent and the benefit/cost (B/C) ratio was estimated to be less than one. If the only livestock benefits were additional early spring forage and additional forage for herd expansion, this suggests that the seeding cannot be considered beneficial if grazed under traditional grazing patterns with hay limiting. Based on the B/C ratio, benefits were estimated to be only 93% that of costs.

There are at least three reasons why the seeding would not have positive benefits under these circumstances. First, the Saval Ranch already has a considerable number of acres of existing crested wheatgrass (4,200 acres). These existing stands are generally adequate for spring forage requirements. Second, winter feed is the most limiting forage resource on the ranch. Developing additional grazing resources does not solve the more important need for winter feed. Without developing and/or improving existing hayland production on the ranch, additional grazing forage will only add to the existing forage imbalance. The third reason why the seeding is not estimated to yield positive economic returns is the diverse species composition used for the new seeding. As mentioned earlier, the policy of "not planting a monoculture of crested wheatgrass" increased seed cost by $7.30 per acre or by $17,738 for the total 2,430 acres seeded. Had this expense not been incurred, the present net worth of the seeding would be estimated at minus $2,429 as compared to minus $20,167 with the additional seed cost. Thus, had these additional costs not been incurred, the seeding would have been basically a break-even investment under a hay-limiting scenario (considering only livestock benefits).

Table 9.5. Plowing and seeding costs for the Lower Sheep Creek Seeding, Saval Ranch.

Expense Category	Total Cost for 2,340 acres	Cost per acre
1. Plowing		
Contract plowing	$30,254	$12.45
Repair	6,318	2.60
SUBTOTAL Plowing	36,572	15.05
2. Seeding		
Contract seeding	12,150	5.00
Seeder repair	875	0.36
Seed: per acre seeding rates		
5 lbs crested wheatgrass @ $.68	8,262	3.40
2 lbs pubescent wheatgrass @ $1.47	7,144	2.94
2 lbs Russian wildrye @ $.85	4,131	1.70
1/2 lb* ladak alfalfa @ $1.14	1,409	0.58
1/2 lb* small burnet @ $3.55	4,325	1.78
1 lb sweetclover @ $.30	729	0.30
SUBTOTAL Seeding	39,025	16.06
3. General expenses		
Transport of plow and seeder from Vale, Oregon	840	0.35
Non-use of range (310 existing AUM's x $5.70/AUM x 1 year)	1,767	0.73
SUBTOTAL General	2,607	1.08
TOTAL	$78,204	$32.18

*Original estimate used for _ex ante_ analysis.

Table 9.6. Benefit/Cost analysis of the Lower Sheep Creek Seeding under traditional grazing patterns when winter feed is the limiting resource.

Annual benefits	
Increased livestock sales	$21,028
Increased grazing fees (972 AUM's @ $2.02)[1]	1,963
Total Annual Benefit	$22,991
Annual costs	
Increased production costs	15,265
Seeding maintenance cost	782
Net Annual Benefit	$ 6,944
Present value of $6,944 (50 years @ 7-7/8%)	86,186
Present value of $28,800 worth of breeding stock from Year 50[2]	651
Required range improvement investment	-78,204
Purchase of 64 additional cows and 4 bulls	-28,800
Present Net Worth	$-20,167
Internal Rate of Return (IRR)	6.26%
Benefit/Cost Ratio	.93

[1]Although grazing fees reflect out-of-pocket costs for the Saval Ranch, they are merely transfer payments from the point of view of society. Therefore, grazing fees should be excluded from the calculation of the change in net income when deriving the marginal value of forage to society.
To account for this, since the additional grazing fees are included in the $15,265 increase in livestock production costs for the Saval Ranch, an equivalent amount, $1,963 ($2.02 x 972 AUM's = $1,963) is added as a benefit. The $2.02 fee used in the analysis reflects the 1979-81 average of Federal grazing fees.

[2]In order for the Saval Ranch to fully utilize the additional grazing resource, herd size must be expanded by 64 cows and 4 bulls. At the end of the 500 year planning horizon, the investment in additional livestock is added back as a benefit. Mature cows were valued at $400 per head, and additional purchased bulls were valued at $800 per head and discounted to present value.

Table 9.7. Benefit/Cost analysis of the Lower Sheep Creek Seeding under traditional grazing patterns when range forage is the limiting resource.

Annual benefits	
Increased livestock sales	$ 17,742
Increased grazing fees (972 AUM's @ $2.02)	1,963
Total Annual Benefit	$ 19,705
Annual costs	
Increased production costs	10,251
Seeding maintenance cost	782
Net Annual Benefit	$ 8,672
Present value of $8,672 (50 years @ 7-7/8%)	107,633
Present value of $24,000 worth of breeding stock from Year 50	542
Required range improvement investment	-78,204
Purchase of 54 additional cows and 3 bulls	-24,000
Present Net Worth	$ 5,971
Internal Rate of Return (IRR)	8.36%
Benefit/Cost Ratio	1.03

Traditional Grazing Patterns--Hay not Limiting. Assuming that the Saval Ranch was initially fertilizing one-third of available hayland on the ranch (increasing hay production by an estimated 705 tons), then optimal herd size would be 762 brood cows. After adding the seeding, optimal herd size would increase to 816 brood cows (Torell et al. in press). Under these conditions (sufficient winter feed), the economics of seeding is positive (Table 9.7). This result shows the dependence of positive seeding economics upon resource balance. Seasonal forage balance must be considered when assessing the need and worth of a seeding.

Grazing System--Hay not Limiting. Present net worth of the range improvements and the grazing management system was estimated to be $62,542. The internal rate of return was estimated at 9.39%, and the calculated B/C ratio was 1.14:1.

The grazing system, which will include an estimated $192,926 in range improvements, is then estimated to be cost effective with benefits exceeding costs based totally on benefits to livestock. Additional expected wildlife and watershed benefits, which were not included in the B/C analysis, would further improve the economics of the grazing system. A complete discussion of the economic analysis of the proposed Saval grazing system is provided by Torell et al. (in press).

Assumptions Versus 1983 Field Measurements. For the economic analysis, various assumptions had to be made with respect to forage availability through time on the LSC. This estimate was made by assuming that the new LSC Seeding would be as productive as the Darling Seeding (2.14 acres/-AUM) (Torell et al. in press). Based on 2,430 acres seeded, the estimated forage benefit of the seeding was 972 AUM's of additional livestock grazing capacity, bringing total grazing capacity on the LSC Pasture to 1,282 AUM's when non-seeded areas are also considered. Forage production in the pasture was estimated during 1983 to be 955 AUM's (see this Chapter, VEGETATION RESPONSE). Unless stand productivity improves with time, it would appear that the initial projection was overly optimistic, which would tend to make the initial estimate of benefits also somewhat high.

CONCLUSION

The LSC Seeding will be profitable only if the existing hay shortage on the Saval Ranch is eliminated or equivalent steps are taken to provide winter forage. The mixed-species stand does little to alleviate the forage bottleneck on the Saval -- that being winter feed. Saval Ranch planners must consider alternative ways of providing additional winter feed: perhaps meadow improvement, meadow fertilization, shipping cows to southern Nevada for the winter, and/or alternative schemes. Without additional winter feed sources, additional spring and summer forage resources from seedings and/or the grazing system will not be economically harvested.

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Chapter 10

RANCH ECONOMICS

L. Allen Torell

1983 Objective:

Continue to obtain baseline data for use in future analyses.

1983 Accomplishments:

A Visi-Calc ranch planning computer program was developed for the Saval Ranch as discussed in the last progress report (Torell 1983). This program was used to keep track of herd size adjustments as reported by R. Vance, Ranch Manager, and agency grazing records (Tables 10.1-10.2)

Similar data will be compiled for 1983 after meeting with the Saval Ranch Manager this spring.

1983 Objective:

Continue to monitor changes in livestock production costs brought about by the grazing system.

1983 Accomplishments:

Implementation of a cost study being conducted on the Saval Ranch was reported in last year's progress report (Torell 1983). This cost study, which considered as a case study the total cost of grazing Federal rangeland on the Saval Ranch, was completed (Torell et al. in press). The analysis provides an estimate of labor and activity costs for specific land ownership classes. The summary of labor activities performed on the ranch will serve two primary purposes.

First, the labor summary provides a base upon which ranch labor statistics in future years can be compared to determine how the grazing system affected labor requirements. Second, the study provides an estimate of the cost of grazing each of the various classes of rangeland.

The paper has been sent to the Journal of Range Management for consideration for publication. In the interim a summary of procedures and results is provided here.

Procedure

Weekly ranch labor summaries were compiled for 1982. Each Saval Ranch employee recorded the hours spent performing various tasks during the week on a time sheet. This procedure was followed throughout the grazing season. Similar data were estimated for the winter feeding period by the Saval Ranch manager. For simplicity, ranch activities were grouped into the 11 general categories outlined and described in Table 10.3. Labor

Table 10.1. 1982 stock count chart.

SEASON	COWS	AUMS	YEARL. REPL.	AUMS	STEER CALVES	HEIFER CALVES	AUMS	BULLS	AUMS	AUMS REQUIRED
APR. 16 - MAY 31	1210	1815	100	105	(BORN)	(BORN)		82	123	2043
JUNE 1 - JUNE 30	1210	1210	100	70				82	82	1362
JULY 1 - AUGUST 15	1054	1581	100	105				82	123	1809
AUGUST 16-SEPT. 30	1054	1581	100	105				82	123	1809
OCT. 1 - OCT. 31	1054	1054	100	70	348	314	331	82	82	1537
NOV. 1 - DEC. 15	897	1346			348	314	497	82	154	1996
DEC. 16 - APRIL 15	713	2577						82	413	2990
TOTAL		11163		455			828		1100	13546

Table 10.2. Forage Balance Chart.

	BLM		FS	PRIVATE					
SEASON	SHEEP/ MAHALA CREEK (AUMS)	DARLING SEEDING (AUMS)	INDEPEN-DENCE (AUMS)	ALLABACK (AUMS)	TREMEWAN SEEDING (AUMS)	PRIVATE RANGE (AUMS)	RAISED HAY (AUMS)	AVAIL. (AUMS)	AUMS REQUIRED
APR. 16 - MAY 31	455	1070			392	126		2043	2043
JUNE 1 - JUNE 30	943	52	92	157		118		1362	1362
JULY 1 - AUGUST 15			1704			105		1809	1809
AUGUST 16-SEPT. 30			1704			105		1809	1809
OCT. 1 - OCT. 31						1537		1537	1537
NOV. 1 - DEC. 15		277				1719		1996	1996
DEC. 16 - APRIL 15							2990	2990	2990
TOTAL FORAGE USED	1398	1399	3500	157	392	3710	2990	13546	13546

Table 10.3. Ranch activities performed under each general labor activity designation.

Activity Designation	General Activities Included
Winter Care of Cattle	Checking and doctoring cattle during the winter and spring months. Calving during the spring.
Winter Feeding	Feeding cattle hay during the winter months.
Ranch Maintenance	Repair of buildings, corrals, roads, and vehicles. Excludes range improvement maintenance and repair of haying equipment.
Haying	Putting up grass hay for winter feeding. Includes repair of haying equipment.
Irrigating	Flood irrigation of meadowland. Includes ditch repair of haying equipment.
Working Cattle	Branding, vaccinating, weaning, and marketing of cattle.
Moving Cattle	Herding cattle between allotments. Excludes herding while on a particular pasture.
Range Improvement Maintenance	Maintenance of fences, cattle guards, and other range improvements on both Federal and private lands.
Summer Care of Cattle	Herding cattle for better distribution on the pasture, salting, and checking cattle on range. Includes travel time to and from the pasture.
Ranch Management	Management, bookkeeping, and office work.
Miscellaneous	Shoeing horses, going to town, and other odd jobs.

Table 10.4. Saval Ranch forage costs summary.

	Private Deeded ($/AUM)	BLM ($/AUM)	USFS ($/AUM)	Combined Fed. ($/AUM)
Cash Cost[1]				
Moving Cattle	.82	1.20	1.28	1.24
Range Improvement Maintenance	1.11	.18	.28	.23
Care of Cattle on Range	.18	.27	1.10	.72
Lost Animals	1.31	1.31	1.31	1.31
Grazing Fee	--	1.86	1.86	1.86
SUBTOTAL	3.42	4.82	5.83	5.36
NONCASH COSTS				
Development Depreciation	.29	.00	.00	.00
Interest on Investment	21.28	3.25	3.25	3.25
SUBTOTAL	21.57	3.25	3.25	3.25
TOTAL	$24.99	$8.08	$9.08	$8.61

[1]Depreciation and "opportunity cost" charges on vehicles, which are "noncash" expenses have been included as cash costs for simplicity. This results in a slight descrepancy between "cash" and "noncash" expense classifications.

costs, other cash costs, and non-cash costs were calculated and allocated to range forage grazing activities on National Forest, BLM, and private rangeland based upon the resulting labor allocation.

Results

The total annual labor imput into the ranch was 12,859 hours (Fig. 10.1). Of this total, 2,646 hours were expended specifically for the purpose of harvesting range forage: 1,429 hours moving cattle, 613 hours maintaining range improvement, and 604 hours caring for cattle on range. These three labor activities accounted for 20.6 percent of the annual ranch labor input. Hay production was the largest single category of annual labor input at 25 percent.

The Estimated cost per AUM for grazing private deeded rangeland, BLM, and USFS are presented in Table 10.4. Private deeded forage is by far the most expensive forage source at nearly $25 per AUM with interest on investment making up 85 percent of this cost. BLM forage comes out as the cheapest forage source on the ranch at $8.07 per AUM. USFS forage is estimated to cost over $1.00 per AUM more in non-fee cost than BLM forage. The major difference is care of cattle on range; which includes salting, checking cattle, and herding cattle for better distribution.

Cost of production data for the Saval Ranch were not recorded during 1983. Data collected during 1979, 1980, and 1982 provide an adequate "picture" of the initial economic base of the ranch. These costs have been incorporated in economic models developed for the ranch as discussed by Totell (1983). I see no further need to collect cost/income relationships specific to the Saval Ranch, at least not until the grazing system has been in place for a number of years and the <u>ex post</u> assessment of the system is made. At that time up-to-date costs and prices will be needed.

<u>1983 Objective</u>:

Evaluate the effect of alternative management strategies on ranch income and ranch management.

<u>1983 Accomplishments</u>:

Numerous alternative livestock management strategies were analyzed for consideration on the Saval Ranch. Major options considered included meadow improvement, the economics of the Lower Sheep Creek seeding, cow-calf versus cow-calf/yearling management, and an economic analysis of the proposed grazing system. Preliminary results of all of these management scenarios were presented in last year's progress report (Eckert 1983). The results of this research has been reported as a research paper titled "Optimal Livestock Production on the Saval Ranch under Season-long Grazing and under the Proposed Deferred/Rest Rotation Grazing System."

The paper has been reviewed as required by Saval Project review procedures and is being considered for publication as a Utah State University Experiment Station Bulletin (Torell et al. in press). The interested reader is referred to the previous progress report (Torell 1983) for a

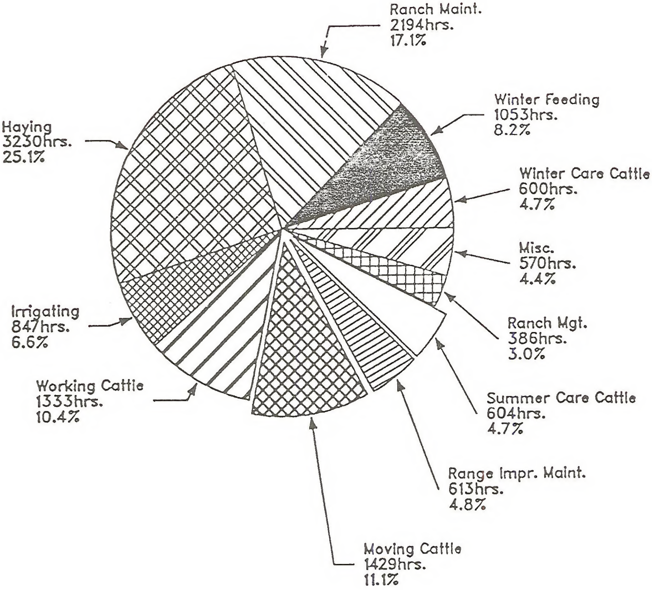

Fig. 10.1. Ranch labor input by general labor category.

summary of results.

A specific treatment of the economic value of the mixed-species seeding on the Saval Ranch was presented at the Crested Wheatgrass Symposium held October 3-7, 1983. The presentation, which will be puvlished in the proceedings (Torell in press), relied heavily upon economic analysis in Torell et al. (in press) with respect to the economics of the new Lower Sheep Creek seeding. The analysis included consideration of the economic value of crested wheatgrass when winter feed is limiting and traditional grazing patterns are followed, when winter feed is not limiting and traditional grazing patterns are followed, and when the seeding is added as an integral part of the Saval grazing system. Major conclusions were that seedings may not always be profitable. The addition of a stand of crested wheatgrass must "fit in," that is, it must alleviate some forage constraint on the ranch. Also; full, positive economic benefits for livestock production from crested wheatgrass stands may be compromised by the federal lands policy of not planting a crested wheatgrass monoculture. The additional legumes and species planted in the Lower Sheep Creek seeding more than doubled seed cost. Unless non-livestock resource benefits are expected to be very large from inclusion of these additional forage species, and also long lived, then seeding economics will be adversely affected.

Data Collection Recommendations and Future Plans

The final "goal" of the economics section of the Saval Project is to be able to be able to make an *ex post* assessment of the economics of the implemented grazing system. With this in mind, economic baseline data needs were evaluated. Since a major part of any economic study is quantification of pertinent physical and biological relationships, the sampling design and collection of these data by the range and livestock personnel on the project have been stressed. To reiterate here, the livestock production parameters necessary for a satisfactory *ex post* economic assessment of the grazing system include:

(1) An estimate of calving percentage for each year of the project. Quantification of the *change* in percent calf crop which is attributable to implementation of the grazing system is of primary importance.

(2) An estimate of weaning and selling weights for each year of the grazing system. Again, quantification of the *change* in livestock weights due to the grazing system is of primary importance.

(3) An estimate of any changes in death loss, replacement rates, or cow/bull ratios which are necessary for management of the grazing system.

Key forage production parameters include:

(1) An estimate of forage availability by pasture and by year. The forage estimate should indicate how many livestock AUM's

could have been removed from the pasture in any given year. This estimate should include any limitations and restrictions that are imposed by Federal lands grazing policies. Similar to required livestock parameters, the key interest is a quantification of the change in livestock forage availability.

(2) Changes in forage quality through time that can be attributed to the grazing system. The effect of "forage quality" on livestock production should be determined from collected livestock production parameters. An estimate of changes in forage quality such as Total Digestible Nitrogen (TDN) or protein of the diet, would also be useful.

With these livestock and forage data, the economic evaluation of the grazing system becomes relatively easy and reliable. The final livestock economic analysis comes down to attaching a value to increased livestock production resulting from the grazing system, including increased forage availability and improved livestock production benefits. These "benefits" are then compared to the "costs" of implementing and maintaining the grazing system. A final benefit/cost assessment can then be made.

These date requirements are only for an assessment of impacts of the grazing system on livestock or ranch economics. Much additional data will be needed to assess non-livestock (non-firm) economics.

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CHAPTER 11

DATA MANAGEMENT AND MODELLING

Mack Barrington and Peter C. Lent

Background:

A major problem in a study the size of Saval is the storage, access, analysis, interpretation and publication of data. If a system is set up to take care of most of the phases in the first three steps of this process, then publication of results becomes more timely and is more accurate.

Reviews of the project have pointed to data management as a critical factor for success. Early efforts in this regard involved individual data management. That is, each person had his or her own approach to the problem. Because of this fragmented approach, the project leaders decided to address this problem.

The initial modelling efforts by Adaptive Environmental Assessments (Sonntag et al. 1982) also pointed to this weakness in planning. That report recommended a centralized data base system. The authors listed three advantages to such a system.

1.) All data can be accessed from one location.

2.) Analysis of the data across subject areas, between spatial areas and through time is greatly facilitated, and

3.) Tabulation or graphical display of results can be performed quickly.

They further suggested ways the data should be arranged. The system should 1.) store data independently of application programs which use the data (statistical packages, graphics routines, etc.), 2.) represent the associations inherent in the data, 3.) be flexible to allow new data types, cross-references and applications to be added in the future, and 4.) be easily understood by users with no training in programming.

We put together a comprehensive proposal in May 1982 that addressed these points and provided several alternatives. This document was brought before the steering committee during the spring 1982 meeting. No action was taken at that time. This proposal was refined and presented to the committee during the spring 1983 meeting and further discussion ensued.

Based on these discussions it was recommended that the Elko group make a trip to Boise, Idaho, to visit with personnel in the BLM Idaho State Office and researchers at the Birds of Prey Research Area (BPRA). The BPRA people had gone through a similar crisis in data management a few years earlier. Valuable insight was gained at that meeting which initiated action on data management for the Saval.

Ms. Karen Steenhof of the BPRA was invited to the fall steering committee

meeting in Elko to explain data management alternatives. Based on this information it was decided to use the BLM's Denver Service Center (DSC) Honeywell DPS8 system. The DSC system offers a good choice of software, network capabilities and hardware to support work done on Saval. The statistical packages at DSC are adequate for handling large data sets for many project needs.

The major feature at the DSC is the REX2 (ASPN/2) data base system, considered by many to be one of the best data base systems in existence. It is very user friendly and flexible enough for handling large data sets such as those for the Saval.

All data collected on the Saval in the future will be entered into a REX data base. This file entry will be from several remote terminals, BLM, Idaho State Office, Nevada State Office, University of Nevada - Reno and Elko BLM District Office. In addition the Apple System in the Saval Project Elko Office has been used to access the DSC.

For specialized routines and analyses other systems; such as the USDA Univac system in Fort Collins, and the UNR computer, may be made available through Telenet.

1983 Accomplishments:

Since the start of 1983 preliminary steps have been taken to get everyone on the project in an integrated "state of mind" about data gathering, data management, data analysis, and publication of results. This effort was initiated by the modelling exercises in 1981.

Perhaps the most significant step has been the agreement on the need for data storage and retrieval and the system to do this. Major emphasis has been the formulation of a locator system by which to store, sort and retrieve spatial information on vegetation types, soils, ecological sites, topography, climate, research plots, animal movements, etc.

Data locator is the Universal Transverse Mercator (UTM) system. We have chosen this system because it is uniform across all maps and management systems and produces one hectare grid cells. Using UTM, data can be assigned to a specific cell with concise X and Y coordinate values.

The master file with these elements will be set up on removable disk pack in DSC. The data elements in this file will include (by one hectare cell):

1.) X coordinate
2.) Y coordinate
3.) Predominant ownership (BLM, USFS, Private)
4.) Road presence (1-yes, 0-no)
5.) Fence presence (1-yes, 0-no)
6.) Pasture number (2 digit code)
7.) Water presence (0-none, 1-9 type-spring etc.)
8.) Elevation (40 ft. intervals)
9.) Slope (5% intervals)
10.) Aspect (45 degree intervals)

11.) Soil Associations
12.) Special habitat features (cliffs etc.)
13.) Special research features (exclosures, trend plots, etc.)
14.) Vegetation type (current)
15.) Climate station type

The organization and content of this master file is still undergoing final discussions. While the system should be fully operational by the end of 1984, it is not anticipated that all values for all grid cells will be entered. Initially only cells for which individual disciplines have data will be entered in the master data base.

BLM charge codes and passwords have been set up with the DSC for Saval use. Along with these comes a limited amount of storage space. Also, independent storage space will be available on removable disk pack or tape.

Future Work on Data Base Management

The priority in the coming months will continue to be the development of individual discipline data files. Definition of data elements for REX will need to be a priority for everyone, to be completed and approved for all participants by the end of Fiscal Year 84.

Secondly, we will continue to work on the development of the master file components. We will be working with the BLM Nevada State Office ADP personnel on this project.

Lower priority will be given to entering basic resource data of the Saval in REX data bases. This information will include the following:

1.) Plant species list with codes and locations collected by grid cell
2.) Mammal species list
3.) Bird species list
4.) Soil series and association descriptions
5.) Ecological site descriptions
6.) Vegetation type descriptions (when complete).

Modelling and Integration

The fourth major workshop as part of the Adaptive Environmental Assessments Inc. modelling and integration assistance was held in Elko on March 15 to 18, 1983.

The workshop had two major objectives:

1) to train four Saval Project scientists as an integration team, with skills in facilitating workshops and building computer simulation models; and

2) to construct a computer simulation model of a riparian zone as a focus for discussing interdisciplinary research on interactions between fisheries, hydrology, vegetation, cattle and hay production.

Gary back, Debbi Easi, Steve Loomis and Waive Stager were chosen for the training and model building efforts. David Marmorek, Peter McNamee and Tim Webb of Environmental and Social Systems Analysts Ltd. conducted the training and are preparing the final report.

During the period of Project reorganization in 1983 the modelling effort was put on hold. Once reorganization was completed the contract was reactivated and completion date was extended until December 1984.

A final riparian zone modelling and research design workshop was held in March 1984. The contractors are now preparing a workshop report and a final contract report. These will be available later in 1984 and will be distributed to interested parties. Anyone wishing copies of these reports should contact Peter Lent.

LITERATURE CITED

Sonntag, N.C., D. Marmorek, P. McNamee, T. Webb, and J. Truett. 1982. Saval Ranch Research Design, Integration and Synthesis -- Modelling Workshop Report. For USDI, Bureau of Land Management. 153p.

APPENDIX I

MEMORANDUM OF UNDERSTANDING

FOR

THE SAVAL RANCH RESEARCH AND EVALUATION PROJECT

among

The Bureau of Land Managment, U.S. Department of the Interior

Agricultural Research Service, U.S. Department of Agriculture

Forest Service, U.S. Department of Agriculture

Soil Conservation Service, U.S. Department of Agriculture

The University of Nevada, Reno

and

The Saval Ranch

I. Purpose

The purpose of this memorandum of understanding (MOU) is to state the general objectives, describe the organizational structure, and establish procedural guidelines for interagency coordinated research and management on and relating to the Saval Research and Evaluation Area. This Area includes lands owned by the Saval Ranch, and Federal lands administered by the Bureau of Land Management and the Forest Service.

The Bureau of Land Management (BLM), the Agricultural Research Service (ARS), the Forest Service (FS), the Soil Conservation Service (SCS), The University of Nevada, Reno (UNR), and the Saval Ranch desire to

enter into this MOU for purposes and work set forth herein. The planned research, monitoring, evaluation, and management will further understanding of the complex relationships among soil, vegetation, water, wildlife, livestock use, and socioeconomic factors related to improved management of western rangelands.

II. AUTHORITIES

Authorities for agencies to participate in this effort are covered by existing Federal Statutes and/or delegations of authority. Authorities relating to cooperative research are in a National Memorandum of Understanding to which the FS, BLM, and SCS are parties, dated November 1980; a Master Memorandum of Understanding between the Department of Agriculture and the Department of the Interior, dated January 19, 1981; and an agreement between ARS and UNR, dated June 8, 1973.

III. OBJECTIVES

A. Develop an overall project plan which defines the information needs to be met and the tasks to be completed, projects funding arrangements, and assigns specific responsibilities among the participating parties.

B. Conduct research on and evaluate the effectiveness of rangeland management practices on livestock production; vegetation; fish and wildlife and their habitats; soil and water; water quality; socioeconomic factors, including ranch profitability, and other resource values of the Saval area.

C. Ensure that the results of this research and evaluation project are made available for application to improve range management practices elsewhere.

IV. ACTIONS

A. Monitor the status of basic physical phenomena, resources, and resource uses on the Saval area to guide sound rangeland management on the area and to detect significant changes in the physical, biological, and cultural features of the area.

B. Develop, implement, and maintain a coordinated and integrated rangeland management system designed to improve the rangeland resources of the area.

C. Design, establish, and accomplish integrated research to explain the relationships between specific management actions and specific changes in the resources of the area and their uses and to extrapolate these findings to other comparable areas.

D. Establish procedures whereby the total socioeconomic benefits and costs of implementing a complete range management system can be addressed.

E. Disseminate the results of the project to project cooperators and other potential users.

V. ORGANIZATION

An Executive Committee (hereafter called "The Committee"), consisting of one or more representatives of each party to this MOU will

approve the overall plan and annual plans for accomplishment of the objectives under this agreement. The Committee will meet at least once annually to receive a report on the accomplishments of the previous year that includes an evaluation of the status of each action item in that year's plan of work, to agree upon a plan of work for the coming year, and to agree upon each party's responsibilities for accomplishing that plan of work. The Committee shall appoint an advisory committee consisting of representatives of groups having an interest in the results of the Saval Project. This advisory committee will convene and meet with the committee ~~Board~~ at least once annually.

There shall be established the positions of Project Manager and Principal Scientist. They shall share joint responsibility for the preparation of an annual report to the Committee.

The Project Manager, as executive officer for the Committee, shall take principal responsibility for the overall coordination, integration and administration of the Project, in cooperation and consultation with the Principal Scientist. The Manager shall serve <u>ex officio</u> on all groups and committees established to implement this agreement.

The Principal Scientist shall chair meetings of scientists and technical personnel working on the Saval Project or at the site, and shall cooperate in the review, editing, publication, and dissemination of project results.

VI. OBLIGATIONS

Each party shall cooperate and participate in implementing of the range management plan, conducting research, and disseminating the results of the project, according to the authorities vested in each and according to their capabilities. Specifically, the BLM agrees to provide the position of Project Manager. The ARS agrees to provide a senior range scientist as Principal Scientist, and the UNR agrees to provide the services of appropriate faculty, as specified in an annual plan of work. The Saval Ranch agrees to provide and manage livestock to implement the agreed-upon range management system, to provide appropriate access for research personnel, and to make operations records available. The use of certain facilities may be provided on a cost-reimbursable basis. The SCS will provide technical assistance in inventories and in the design and implementation of the integrated grazing management plan.

Any transfer of funds between parties to this agreement as reimbursement for additional efforts in support of project accomplishments shall be provided for by separate interagency agreement or contract.

VII. COORDINATION OF ONSITE ACTIVITIES

All parties agree to present plans for any studies, research, or other activities, as well plans for significant changes to the management system, through the Project Manager for the consideration of the Executive Committee prior to implementation. Nothing in this MOU is intended to restrict any of the parties in the procuring of research and professional services according to established procurement procedures from sources not party to the MOU.

VIII. PUBLICATIONS

Joint publication of results by all or several parties to the agreement is encouraged. Separate publication of results shall be allowed, provided that all parties have an opportunity to review manuscripts prior to publication. The Project Manager shall act as coordinator for this review process. Should differences of viewpoint occur, an effort will be made to reconcile them. However, this shall not prohibit any party from publishing the data provided it assumes sole responsibility for the information presented. Credit must be given in any publication to the other parties for cooperation or support furnished. Each party will freely share collected data with other parties and shall furnish to other parties copies of publications as may be agreed upon.

IX. GENERAL CONSIDERATIONS

A. The resource management agencies will retain responsibility for meeting all requirements of law and regulations pertaining to the use and management of the lands and resources under their respective jurisdictions.

B. The SCS may provide technical assistance on the Federal lands since coordinated rangeland resource management will benefit the privately owned lands.

C. The Saval Ranch will hold the Federal Government and cooperating agencies harmless for any injury or death, and for the loss, damage or destruction of property, with the exception of negligent acts of the United States or its employees.

D. The Federal agencies cooperating in this agreement will hold the Saval Ranch harmless for any injury or death, and for loss, damage, or destruction of property, except for negligent acts of the Saval Ranch or its employees.

X. MODIFICATIONS

This MOU will remain in effect until modified by the parties in writing. It is renegotiable at the option of any one of the parties. The addition of other cooperators to the agreement shall require unanimous consent of the present signatories. Any party wishing to withdraw from the MOU shall give other parties 90 days' notice.

XI. EFFECTIVE DATE

This MOU shall take effect as of the date last signed below and shall then supersede the agreement signed on October 12, 1978.

BUREAU OF LAND MANAGEMENT (USDI):

State Director, Nevada

11/2/83
Date

AGRICULTURAL RESEARCH SERVICE (USDA):

Actg W. G Chace
Regional Administrator

11/15/83
Date

FOREST SERVICE (USDA):

for Regional Forester, Intermountain Region

10/14/83
Date

UNIVERSITY OF NEVADA, RENO:

Bernard M. Jones
Dean, College of Agriculture

8-15-83
Date

THE SAVAL RANCH:

Jeanne W Edwards
Owner

8-22-83
Date

Carter B. Gibbs
Director, Intermountain Forest and Range Experiment Station

9-19-83
Date

SOIL CONSERVATION SERVICE (USDA):

State Conservationist, Nevada

11-3-83
Date

MINUTES

First Meeting of the Executive Committee, Saval Ranch

Research and Evaluation Project

December 6, 1983, Reno.

In attendance:

Members -

Mr. Edward F. Spang, Chairman; Nevada State Director, Bureau of Land Management.
Mrs. Jeanne Edwards, Saval Ranching Co.
Dean Bernard M. Jones, College of Agriculture, University of Nevada, Reno.
Mr. Jim W. Doughty, representing Mr. Gerald Thola, Nevada State Conservationist, Soil Conservation Service.
Mr. Dean Plowman, Area Director, Agricultural Research Service.

Others -

Mr. David Tidwell, Special Assistant to the Director, Bureau of Land Management.
Dr. Peter C. Lent, Saval Project Manager.
Dr. Richard Eckert, Principal Scientist (afternoon only).

Absent:

Dr. Duane Lloyd, U. S. Forest Service Representative, was unable to attend due to a family emergency.

1. Mr. Spang welcomed the members of the Executive Committee and asked Mr. Tidwell to start the meeting with an overview of events to date. Mr. Tidwell noted that the Memorandum of Understanding (MOU) establishing the new Executive Committee was now signed by all parties. Minutes of the last meeting of the former Saval Steering Committee were distributed and the status of certain action items in those Minutes were discussed. See Enclosure #1 for summary of status.

2. General organizational matters under the new MOU established on the last date of signing (11/2/83) were discussed. The role and membership of the Saval Project Operations Team was agreed to (Enclosure 2). Committee members stressed the fundamental importance of the Scientific Team to the success of the project and the leadership role of the Principal Scientist within that team approach. It was agreed that the Operations Team and the Scientific Team should communicate with the Project Manager. He would bring major unresolved issues or policy questions to the Executive Committee.

3. The Project Manager was asked to prepare working documents describing the respective roles of the Executive Committee, the Advisory Committee and the Scientific Team. Drafts of these documents will be circulated to Executive Committee members for review by the end of January, 1984. Final versions of these documents should appear in the Annual Report.

4. It was agreed that the Advisory Committee should be formally chartered, if possible. The NV State Director, BLM, would initiate the process for formal authorization of an Advisory Committee, which will include submission of a proposed charter, etc. This charter is to be drafted by the end of January, 1984, for the Executive Committee review prior to forwarding to WO/BLM. Membership on such an Advisory Committee would be national in scope to reflect the intent and purpose of the project. It will communicate directly with the Executive Committee.

5. The contributions of all participants to the Saval Project needed to be more clearly identified. This process would include both assessing the true costs to the ranch of serving as a base for the research project and determining the cost of leasing and operating an equivalent ranch for the research project. UNR will take the lead on this task with BLM assistance. In addition, develop a summary of the benefits to be realized (or scientific objectives) by the entire project that can readily be discussed and related to public interest groups, ranch and agency participants, etc. These assignments to be accomplished by end of February, 1984.

6. The committee strongly supported the Project Manager's efforts to prepare a master calendar of activities for the project. This activity plan should include the major events and activities in ranch management and the annual grazing plan, in addition to major scientific activities. Preparation of the annual plan should be carefully coordinated with the ranch manager and the local operations team and initial draft completed for review by end of January, 1984.

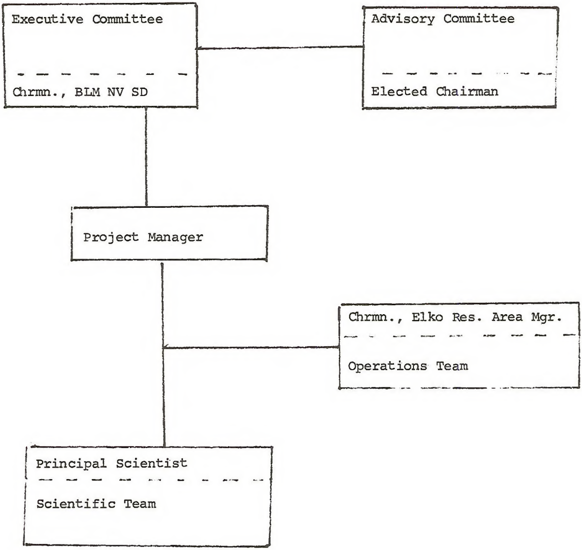
7. After discussion and modifications to the draft document, a publication policy was approved (Enclosure 3).

8. The Project Manager is to ensure the preparation of a more detailed analysis for future use of the Committee that relates the annual budget to specific objectives and to specific products. Material provided in the past was too general. Project Manager briefed the Committee on major events to date and anticipated accomplishments.

9. The Committee strongly urged the two land management agencies to make appropriate administrative designations for the Saval research area to give recognition to and support the research purposes for which these federal lands are being used. It appeared that the Research Natural Area may be an appropriate administrative designation. The BLM State Director agreed to initiate action suggested and coordination with the Forest Service to determine what avenues may be appropriate to meet the intent of the project.

10. Although the goal was to eventually convene the Committee only once a year, the next meeting would be scheduled in a shorter time interval due to the importance of implementing the project under the MOU and related work and organizational needs. Members would be canvassed early in 1984 to agree on a date and location.

SAVAL PROJECT ORGANIZATION



APPENDIX II

Symbol and scientific and common names for plant species reported in current or past reports

SYMBOL	SCIENTIFIC NAME	COMMON NAME
	Tree and Shrub Species	
AMELA	*Amelanchier spp.*	Serviceberry
AMUT	*A. utahensis*	Utah serviceberry
ARTEM	*Artemisia spp.*	Sagebrush
ARLO	*A. longiloba*	Alkali sagebrush (early, low)
ARTR	*A. tridentata*	Big sagebrush
ARTRT	*A. tridentata tridentata*	Basin big sagebrush
ARTRV	*A. tridentata vaseyana*	Mountain big sagebrush
ARTRW	*A. tridentata wyomingensis*	Wyoming big sagebrush
CELA	*Ceratoides lanata*	Common winterfat
CHRYS	*Chrysothamnus spp.*	Rabbitbrush
CHNA	*C. nauseosus*	Rubber rabbitbrush
CHVI	*C. viscidiflorus*	Low Rabbitbrush
PRVI	*Prunus virginiana*	Chokecherry
PURSH	*Purshia spp.*	Bitterbrush
PUTR	*Purshia tridentata*	Antelope bitterbrush
RIBES	*Ribes spp.*	Currant, Gooseberry
RICE	*R. cereum*	Current bush
ROSE	*Rosa spp.*	Rose
SALIX	*Salix spp.*	Willow
SYMPH	*Symphoricarpos spp.*	Snowberry
TECA	*Tetradymia canescens*	Gray horsebrush
	Forb species	
ACLA	*Achillea lanulosa*	Yarrow
ALLIU	*Allium spp.*	Wild onion
ASSC	*Aster scopulorum*	Crag aster
BORAG	Boraginaceae	Borage family
CASTI	*Castilleja spp.*	Paintbrush
CHEVO	*Chenopodium spp.*	Pigweed
COLLO	*Collomia spp.*	Collomia
COMPO	Asteraceae	Composite Family
COPA	*Collinsia parviflora*	Little flower collinsia
CRAC	*Crepis acuminata*	Tapertip hawksbeard
DESCU	*Descurainia spp.*	Tansy mustard
ERIOG	*Eriogonum spp.*	Wild buckwheat
FRAGA	*Fragaria spp.*	Strawberry
GABI	*Galium bifolium*	Bedstraw
HACKE	*Hackelia spp.*	Stickweed
HYCA	*Hydrophyllum capitatum*	Cow cabbage, waterleaf
IVAX	*Iva axillaris*	Poverty sumpweed
LODI	*Lomatium dissectum*	Carrotleaf lomatium
LVCA	*Lupinus caudatus*	Tailcup Lupine

SYMBOL	SCIENTIFIC NAME	COMMON NAME
MESA	*Medicago sativa*	Ladak alfalfa
MEOF	*Melilotus officinalis*	Yellow sweetclover
MECI	*Mertensia ciliata*	Shortstyle bluebell
NAVAR	*Navarretia spp.*	Navarretia
PABR	*Paeonia brownii*	Peony
PHHO	*Phlox hoodii*	Hoods phlox
PHLO	*P. longifolia*	Longleaf phlox
PHORA	*Phoradendron spp.*	Mistletoe
PLANT	*Plantago spp.*	Plantain
POBI	*Polygonum bistortoides*	American bistort
POTEN	*Potentialla spp.*	Cinquefoil
SAMI	*Sanguisorba minor*	Small burnet
SMST	*Smilacina stellata*	Starry false solomon-seal
SPHAE	*Sphaeralcea spp.*	Globe mallow
STACH	*Stachys spp.*	Hedge nettle
VIOLA	*Viola spp.*	Violet
WYAN	*Wyethia amplexicaulis*	Mulesear wyethia
	Grass and grass-like species	
AGROP	*Agropyron spp.*	Wheatgrass
AGDE	*Agropryon desertorum*	Crested wheatgrass (Nordan)
AGSP	*A. spicatum*	Bluebunch Wheatgrass
AGTR	*A. trachycaulum*	Slender wheatgrass
BROMU	*Bromus spp.*	Brome
BRCA	*B. carinatus*	Mountain brome
BRTE	*B. tectorum*	Cheatgrass brome
CAREX	*Carex spp.*	Sedge
ELEOC	*Eleochoris spp.*	Spikerush
ELYMU	*Elymus spp.*	Wildrye
ELCI	*E. cinereus*	Great basin wildrye
ELJU	*E. junceus*	Russian wildrye
FEID	*Festuca idahoensis*	Idaho fescue
HEKI	*Hesperocloa kingii*	Spike fescue
JUNCU	*Juncus spp.*	Rush
MUHLE	*Muhlenbergia spp.*	Muhly
MURI	*M. richardsonis*	Mat muhly
ORWE	*Oryzopsis webberi*	Webber ricegrass
POA	*Poa spp.*	Bluegrass
PONE	*P. nevadensis*	Nevada bluegrass
POPR	*P. pratensis*	Kentucky bluegrass
POSA	*P. sandbergii*	Sandberg bluegrass
SIHY	*Sitanion hystrix*	Bottlebrush squirreltail
STIPA	*Stipa spp.*	Needlegrass
STTH	*S. thurberiana*	Thurber needlegrass
AGTR2	*Agropyron trichophorum*	Pubescent wheatgrass
BRMA	*Bromus marginatus*	Big mountain brome
MEBU	*Melica bulbosa*	Oniongrass
ORHYH	*Oryeopsis hymenoides h.*	Indian ricegrass

Wildlife species reported from the ranch

MAMMALS

SCIENTIFIC NAME	COMMON NAME
Odocoileus hemionus	Mule deer
Antilocapra americana	Pronghorn antelope
Canis latrans	Coyote
Sorex merriami	Merriam shrew
S. palustris	Northern water shrew
Lepus californicus	Black-tailed jackrabbit
Lagurus curtatus	Sagebrush vole
Microtus montanus	Mountain vole
Onychomys leucogaster	Northern grasshopper mouse
Peromyscus maniculatus	Deer mouse
Perognathus parvus	Great Basin pocket mouse
Eutamius minimus	Least chipmunk

BIRDS

Branta canadensis	Canada goose
Anas platyrhynchos	Mallard
Anas acuta	Pintail
Anas strepera	Gadwall
Anas cyanoptera	Cinnamon teal
Anas carolinensis	Green-winged teal
Aythya americana	Redhead
Aythya affinis	Lesser scaup
Centrocercus urophasianus	Sage grouse
Steganopus tricolor	Wilson's phalarope
Zenaida macroura	Mourning dove
Eremopila alpestris	Horned lark
Amphispiza belli	Sage sparrow
Chondestes grammacus	Lark sparrow
Melospiza melodia	Song sparrow
Passerina amoena	Lazuli bunting
Passerella iliaca	Fox sparrow
Pipilo chlorurus	Green-tailed towhee
Pipilo erythrophthalmus	Rufous-sided towhee
Pooecetes gramineus	Vesper sparrow
Spizella breweri	Brewer's sparrow
Zonotrichia leucophrys	White-crowned sparrow
Sturnella neglecta	Western meadowlark
Oreoscoptes montanus	Sage thrasher
Dendroica petechia	Yellow warbler
Troglodytes aedon	House wren
Turdus migratorius	American robin
Empidonax spp.	Empidonax flycatcher
Vireo gilvus	Warbling vireo
Colaptes cafer	Common flicker
Speotyto cunicularia	Burrowing owl
Podiceps caspicus	Eared grebe
E. wrightii	Gray flycatcher

FISH

Salmo clarki (*S. c. henshawi*?)	Humboldt (Lahontan) cutthroat trout

APPENDIX III

CONVERSION TABLE: ENGLISH TO METRIC UNITS

To Convert	Into:	Multiply by:
Acres	Hectares	.4047
Feet	Meters	.3048
Inches	Centimeters	2.5400
Miles	Kilometers	1.6090
Number/square mile	Number/square kilometer	.3863
Pounds	Grams	453.5924
Pounds	Kilograms	.4536
Pounds/acre	Grams/hectare	1120.8115
Pounds/acre	Kilograms/hectare	1.1208
Square feet	Square meters	.0929
Square yards	Square meters	.8361
Temperature (°F) -32	Temperature (C)	5/9
Yards	Meters	.9144
Cubic feet/second	Cubic meter/second	.0283
Cubic feet/second/square mile	Cubic meter/second/square kilometer	.0109